



Nutri2Cycle

Transition towards a more carbon and nutrient efficient agriculture in Europe



Trial potato growing with refined pig manure fractions

Chantal Hendriks, 28-4-2022



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 773682.

Description and aim of the solution

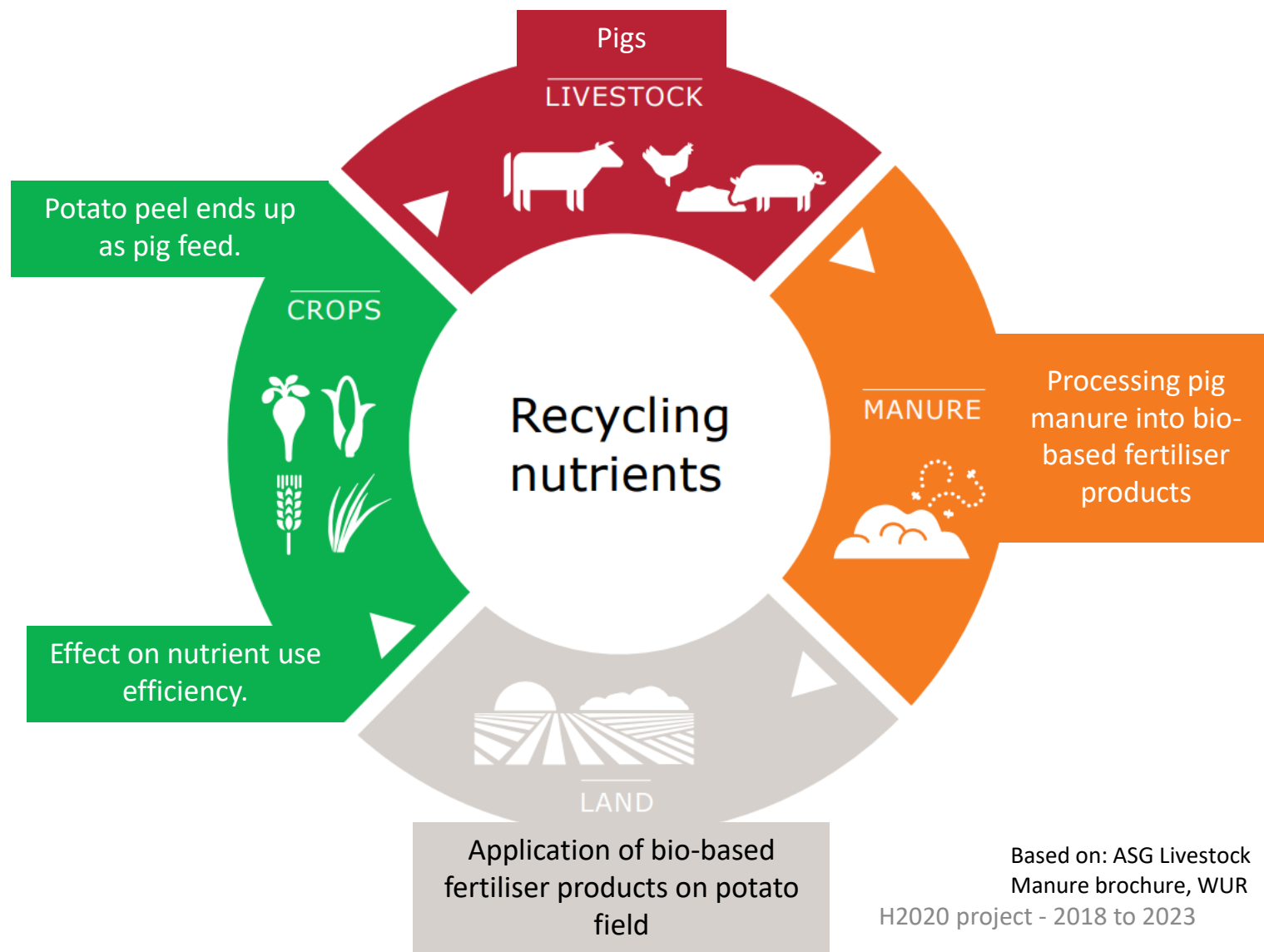


Nutri2Cycle

Analysing the environmental and agronomic effect of different biobased fertilisers (BBFs) on potato growing in sandy soil.

Important because:

- 1) Proving the safe use of biobased fertilisers
- 2) Assessing the potential of closing nutrient loops
- 3) Stimulate the adoption of new techniques



Background



Tools, techniques & systems for higher-precision fertilization



Country: NL (WUR, ZLTO), BE (Ugent)

Biobased fertiliser production

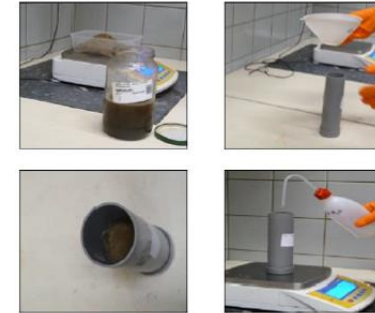
Biobased fertiliser application



Description of the solution



- 3 biobased fertilisers:
 - liquid fraction of digestate (less refined product)
 - ammonium sulphate (refined product)
 - K-concentrate (refined product)
- Environmental evaluation:
 - N release rate (laboratory)
 - GHG emissions after soil application (laboratory)
 - fertilizer replacement value (netting tunnel)
- Agronomic evaluation:
 - potato quality and quantity
 - production/application costs of fertilizer



www.VP-HoBe.nl

Soil characteristics and fertiliser recommendation



Nutri2Cycle

Soil properties	
N total stock (kg/ha)	4030
N-supply capacity (kg/ha)	60
C/N-ratio	13
pH	5.8
C-organic (%)	1.5
OM (%)	3.1
Clay (%)	2
Sand (%)	83

Fertiliser recommendation	
310	N kg/ha/yr
23	SO ₃ kg/ha/yr
70	K ₂ O kg/ha/yr
75	CaO kg/ha/yr
1020	Effective OM kg/ha/yr

Fertilizer characteristics



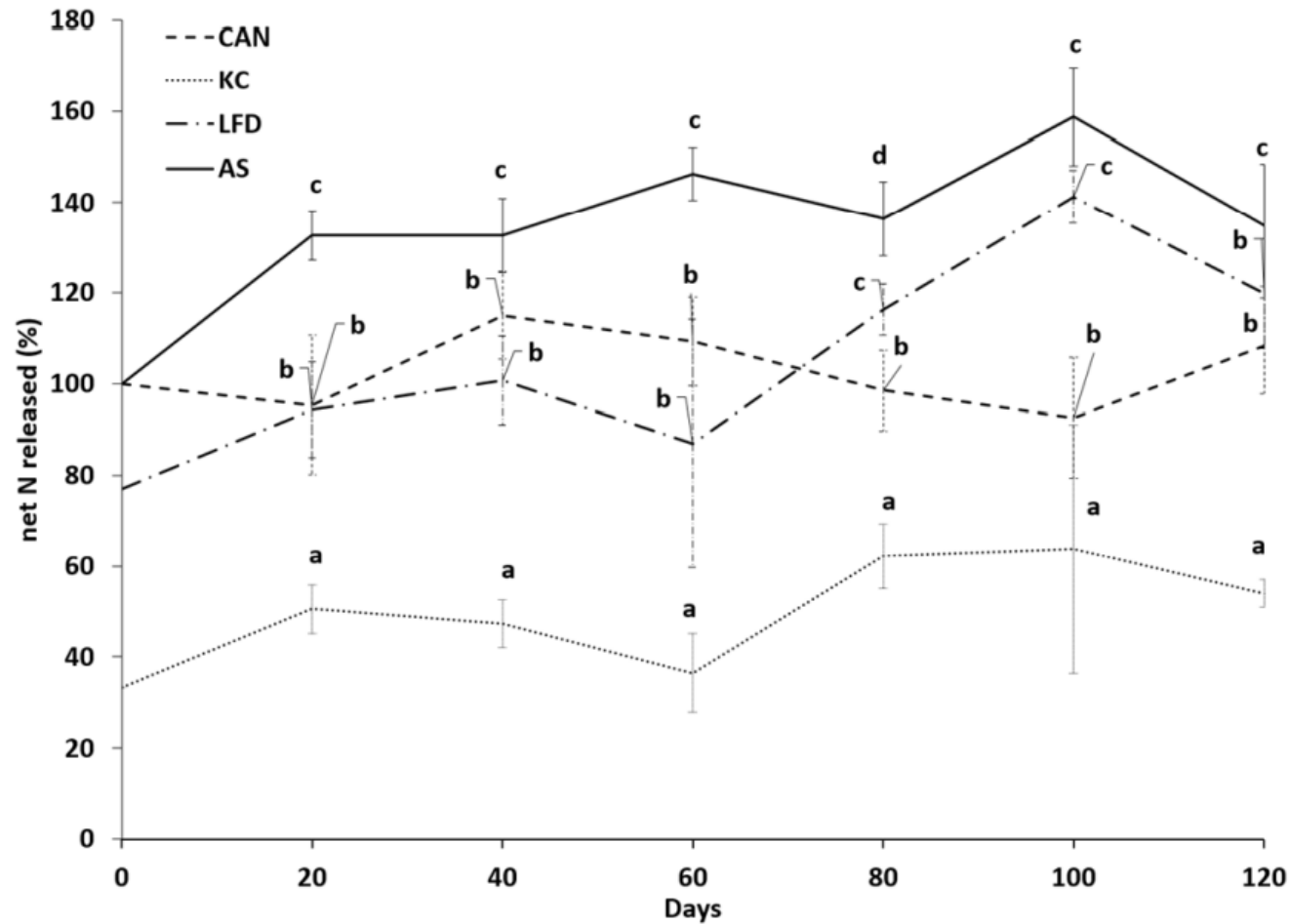
Nutri2Cycle

	DM (%)	OM (g/kg)	N (g/kg)	NH ₄ ⁺ -N (g/kg)	Org.-N (g/kg)	Total C (g/kg)	TOC (g/L)	C/N ratio	P (g/kg)	K (g/kg)	S (g/kg)	pH
Liquid fraction of digestate (LFD)	3	9	4.5	3.7	0.8	9.2	2.8	2	0.7	6.9	0.1	8
Ammonium sulphate (AS)	36	N/A	81.6	81.6	N/A	0.3	0.1	N/A	0.1	N/A	11.9	2.8
K-concentrate (KC)	12	69	6.4	2.5	3.9	41.4	27.8	6.5	4.9	20.7	3	7.4
Slurry manure			3.8						2.4	4.0		

N mineralization rate



Nutri2Cycle

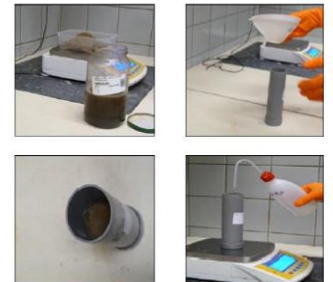


AS: $140 \pm 20\%$ → 100% $\text{NH}_4\text{-N}$ /total N ratio

LFD: $113 \pm 24\%$ → 82% $\text{NH}_4\text{-N}$ /total N ratio

CAN: $105 \pm 15\%$

KC: $54 \pm 15\%$

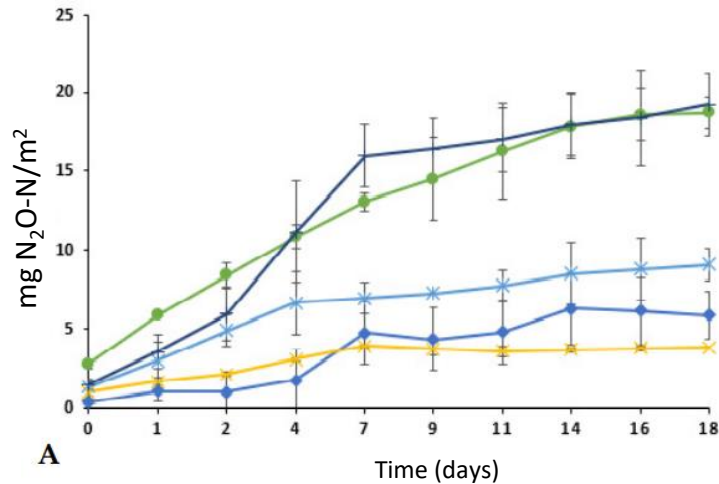


UNIVERSITEIT
GENT

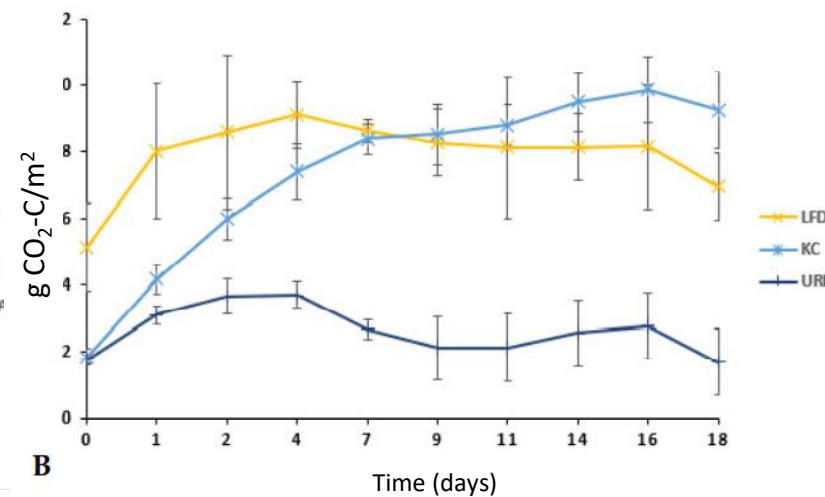
GHG emissions after soil application



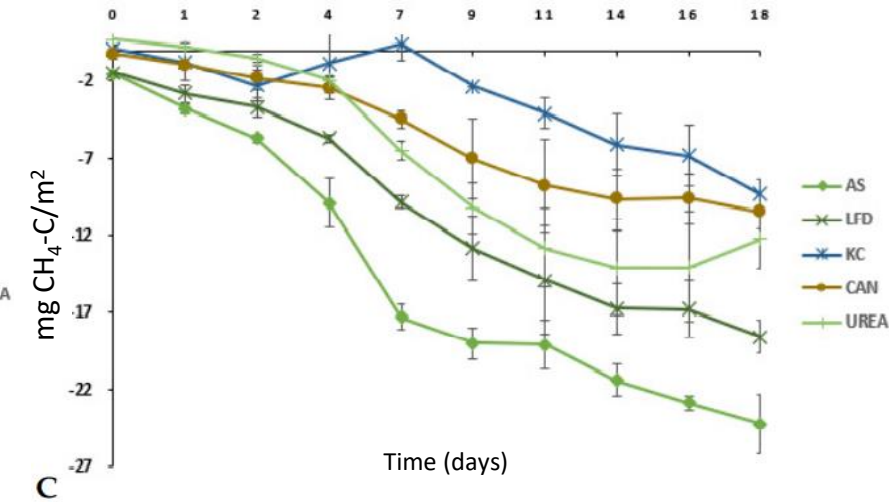
Nutri2Cycle



→ Rapid hydrolysis of products after application, resulting in increased NH₄ availability.



→ Depends on initial OC-content available in BBFs and mineral fertilisers.



→ Aerobic conditions resulting in reduction CH₄ emissions.

Fertilizer replacement value

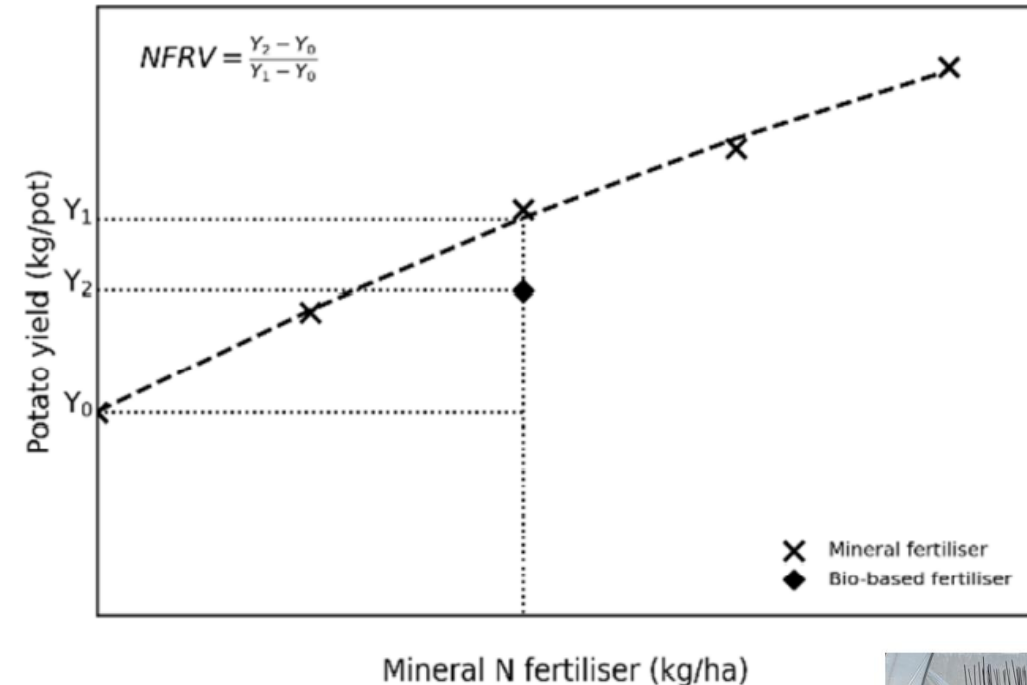


Nutri2Cycle

Treatment	% of advised amount of N
CAN	0
CAN	20
CAN	40
CAN	70
CAN	100
LFD	40
AS	40

→ The corresponding NFRV of N treatments was 1.04 for LFD and 1.13 for AS.

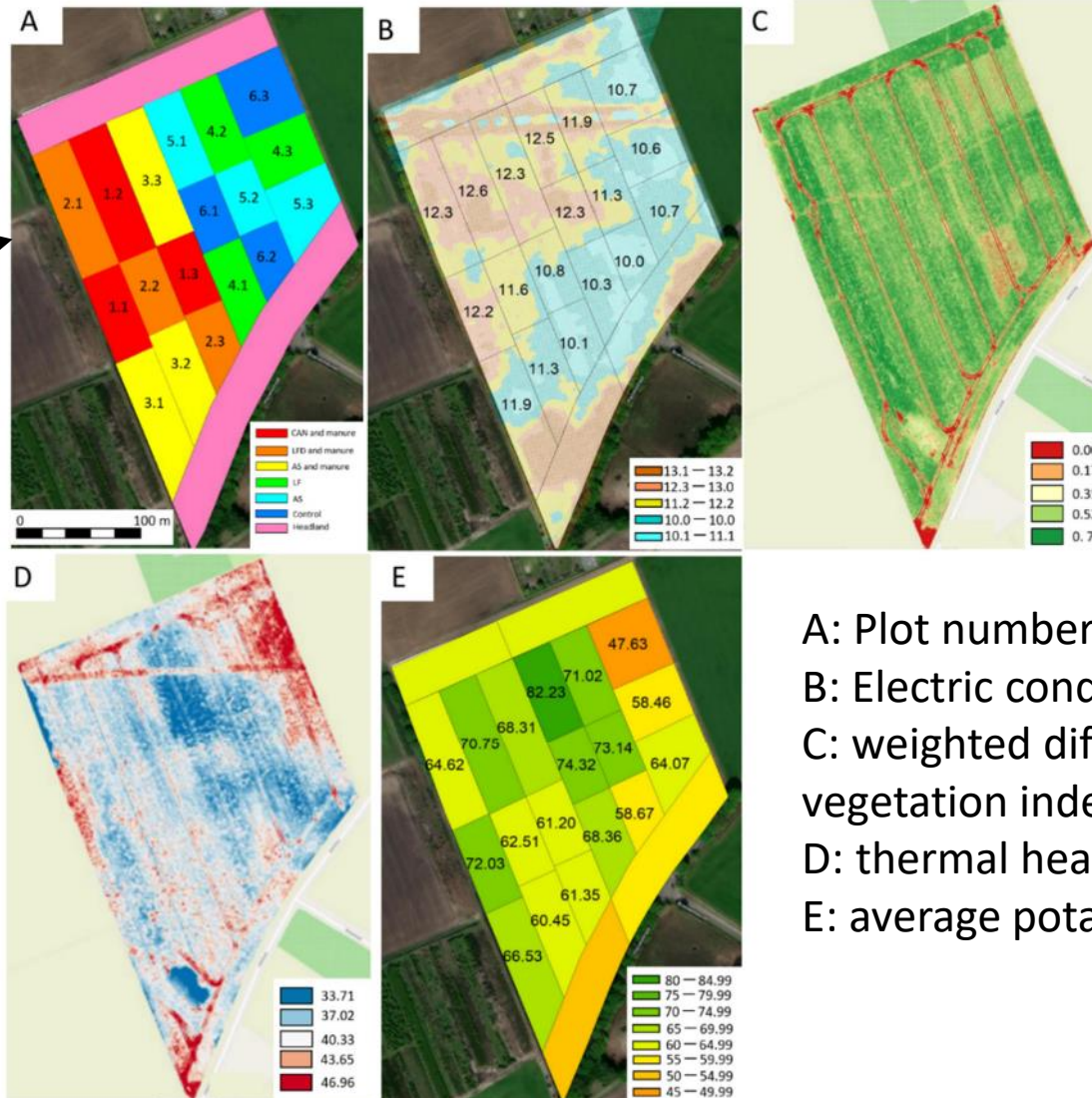
→ Calculating the NFRV based on the N uptake in the potato tuber resulted in a NFRV of 0.50 for LFD and 0.60 for AS.



Potato quality and quantity – field



Nutri2Cycle



03/05/2022

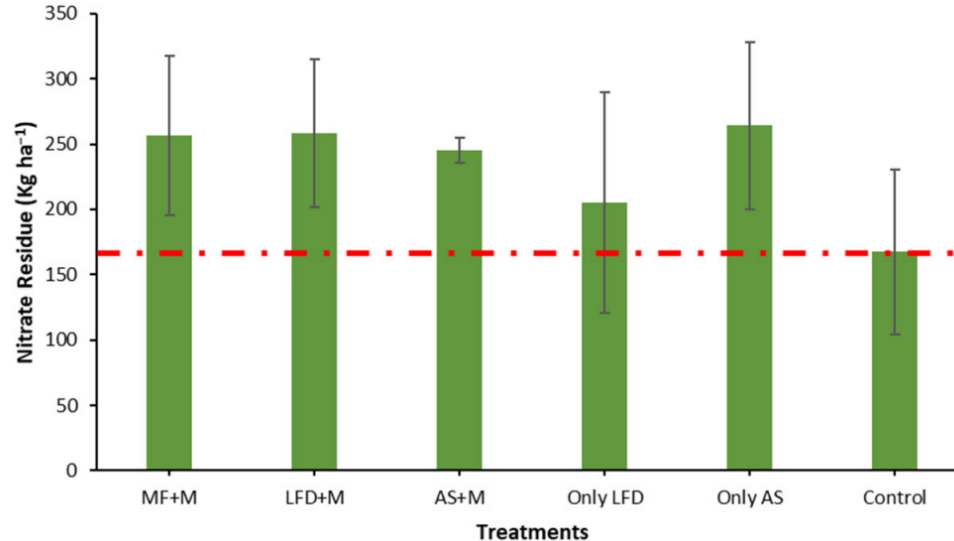
0 project - 2018 to 2023

Potato quality and quantity



Nutri2Cycle

- On average, yields were comparable (except for the control treatment)
- The potatoes of all fields (except the control-treatment) had an under water weight between 70 – 80 g/kg.
- LFD + manure: 59% tuber size < 5 cm



www.VP-HoBe.nl

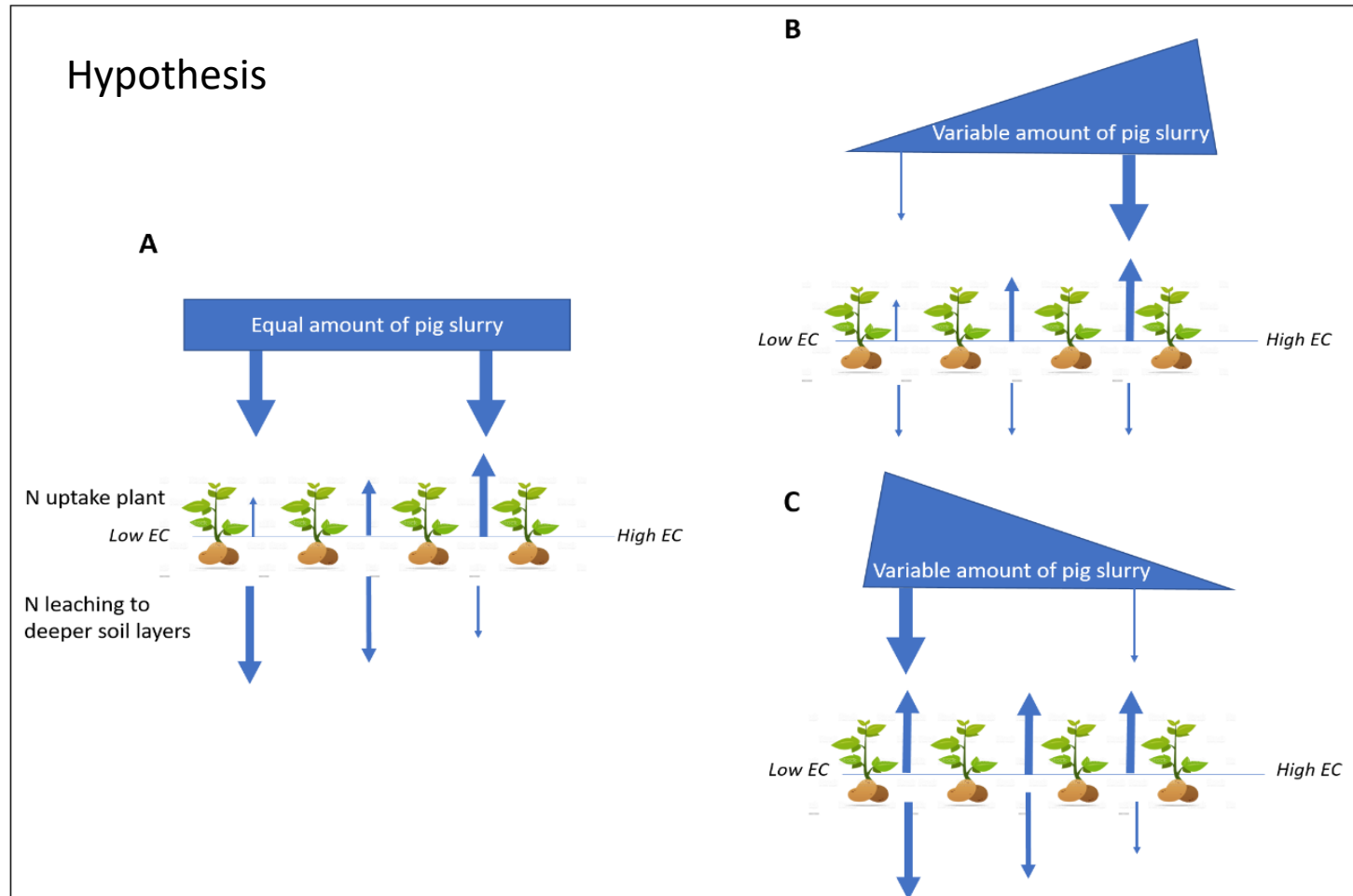


- On short-term it is safe to use biobased fertiliser as a replacement for chemical fertiliser or slurry manure in potato growing on sandy soil.
- Circularity would be stimulated when BBFs are listed as RENURE materials
- Some practical issues that occurred during the application of LFD need to be solved.
- Reducing the surplus of slurry manure to stimulate the use and fair pricing of BBF products
- Remaining question: manure/less-refined BBF in combination with precision fertilization

Follow-up research



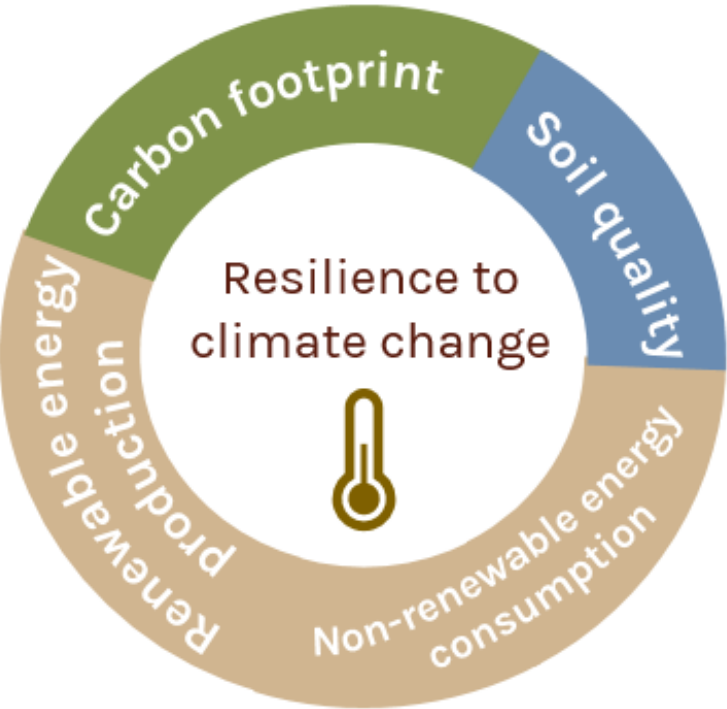
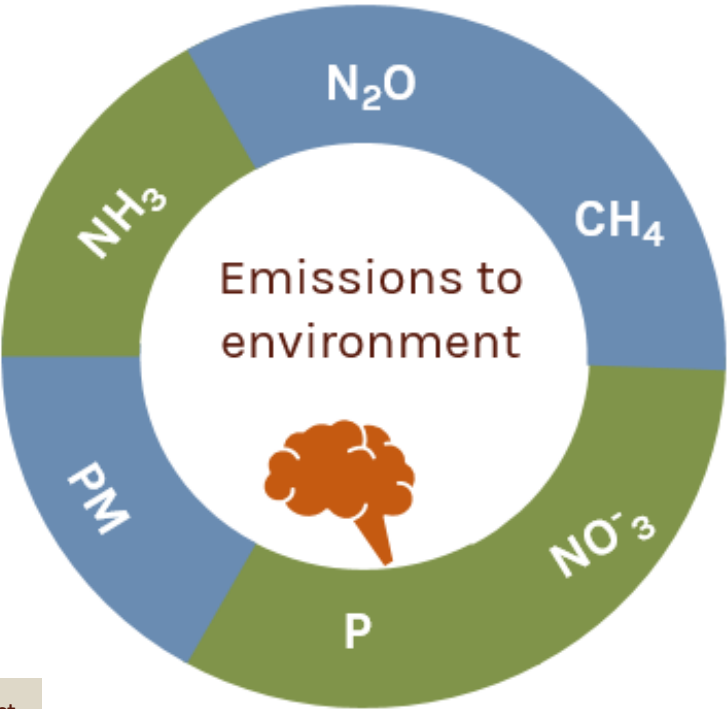
Nutri2Cycle



Conclusions



Nutri2Cycle



Potential impact of the technology

- Positive
- Negative
- Neutral
- Unknown

Chantal.Hendriks@wur.nl

Hendriks et al., 2021; <https://doi.org/10.3390/app12010341>



Nutri2Cycle
Nurturing the Circular Economy

www.nutri2cycle.eu

Twitter: #Nutri2Cycle