NORSØK

Norwegian Centre for Organic Agriculture

soil effects

Long-term effects of slurry and anaerobically digested slurry on soil fertility

Tatiana Rittl, R. Pommeresche, AK. Løes

Viken fylkeskommune velferdstur på Tingvoll gard
29.06.2023

What happens to the soil if the farmer puts the manure in a biogas digester?

Biogas plant

Untreated cow **S**lurry (**US**)

Anaerobic digester in Tingvoll

Biogas

Eletricity

Heat

Anaerobically Digestated Slurry (**ADS**)

Soil Effects long-term experiment (2010-)

To compare long-term effects of anaerobically digested versus non-digested manure (slurry) on soil characteristics and crop yields.

Experimental desing

Treatments

Slurry type

Untreated **S**lurry (**US**)

Anaerobically Digestated Slurry (**ADS**)

Slurry rates

Low (110 kg N ha^{-1})

(Organic farm with small import of feed)

High (220 kg N ha^{-1})

(«Conventional» farm;
or organic with high import of feed)

Treatments

USL

USH

ADSL

ADSH

CONTROL

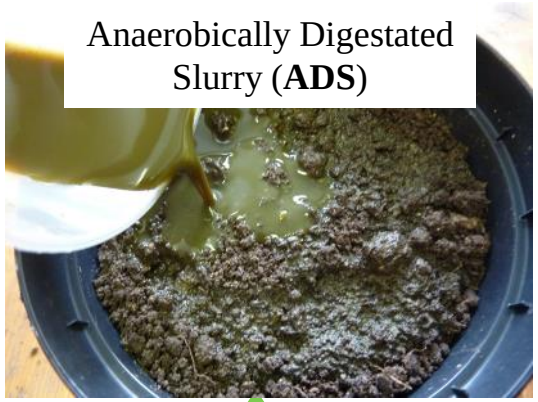
Results (2011-2021)

- Slurry and digestate composition
- SOM content
- Soil fertility
- Yield
- Nutrients balanse (NPK)

What happens with the cow slurry after digestion?

Mean values (*n= 50*) of the chemical analyses over time

Characteristics	US	ADS
Dry matter (%)	5.3	**3.4**
pH (water)	7.4	**7.7**
Tot-N (g/kg)	2.6	**2.2**
NH_4-N (g/kg)	1.5	1.4
NH_4-N tot N (% av tot-N)	60.6	**65.2**
P (g/kg)	0.5	0.4
K (g/kg)	3.1	2.7



Native SOM variation

SOM in the field in 2010

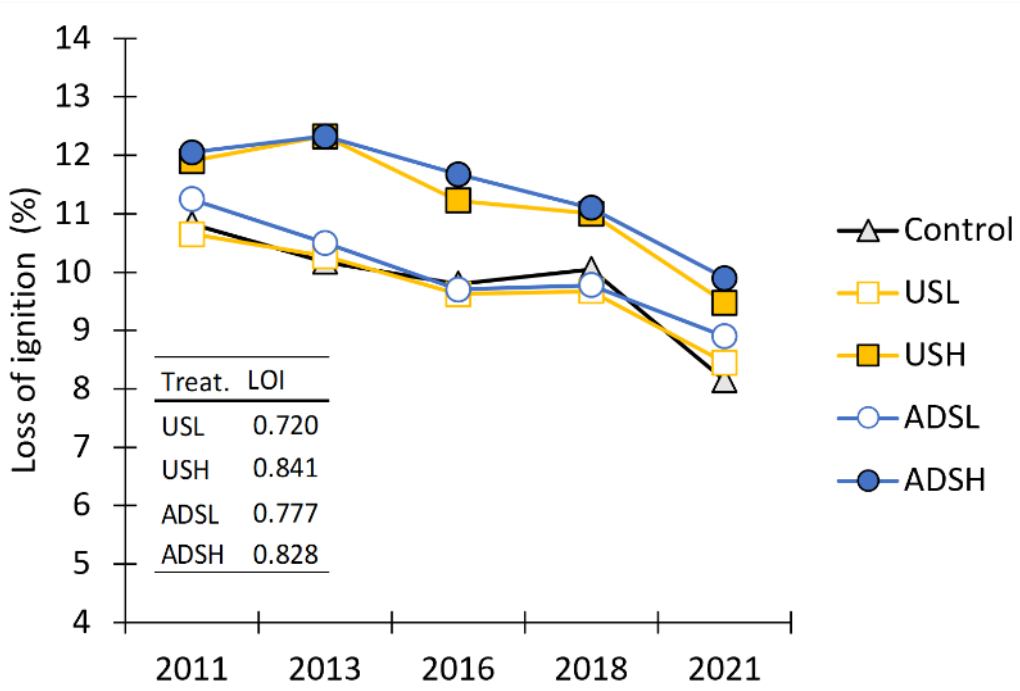
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
A	18,8	22,8	28,5	***21,8***	18,0	13,5	13,1	11,3	10,9	11,0	***10,5***	9,1	8,5	9,0	7,9	8,5	6,6	***11,1***	6,4	6,9	7,1
B	17,4	15,9	14,3	***13,6***	10,1	9,1	8,7	5,1	7,1	7,5	***6,9***	6,7	8,8	8,6	12,5	12,5	12,1	***8,1***	13,0	14,6	11,8
C	8,3	8,2	8,7	***9,2***	8,2	7,1	6,2	5,0	4,7	6,3	***5,4***	5,8	5,2	5,5	4,9	4,1	7,6	***6,6***	9,4	9,3	9,3
D	5,6	4,7	6,3	***6,7***	6,3	6,0	5,3	4,8	5,1	4,9	***5,9***	5,2	4,1	5,2	3,7	4,8	5,9	***4,7***	6,9	6,2	9,8

Legend: Indication of organic matter content by different colours

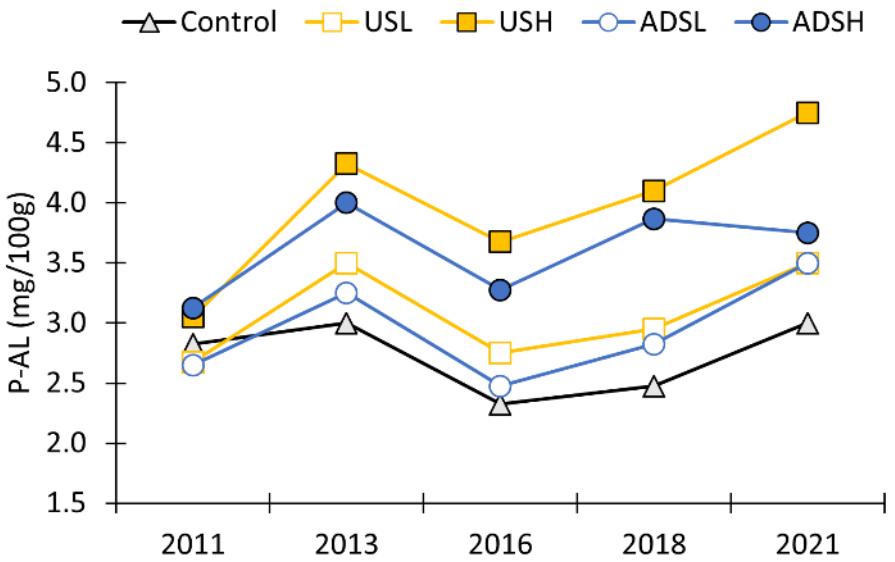
3-4,5%	4,5-6%	6-9%	9-12%	12-20%	>20%

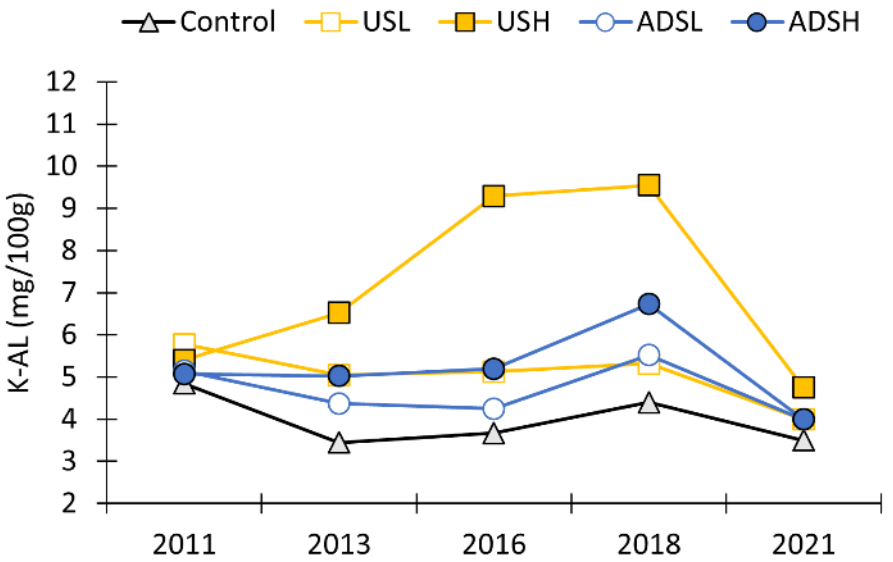
SOM in the treatments

Treatments



P-AL and K-AL





Rittl et al. (under revision)

soil effects

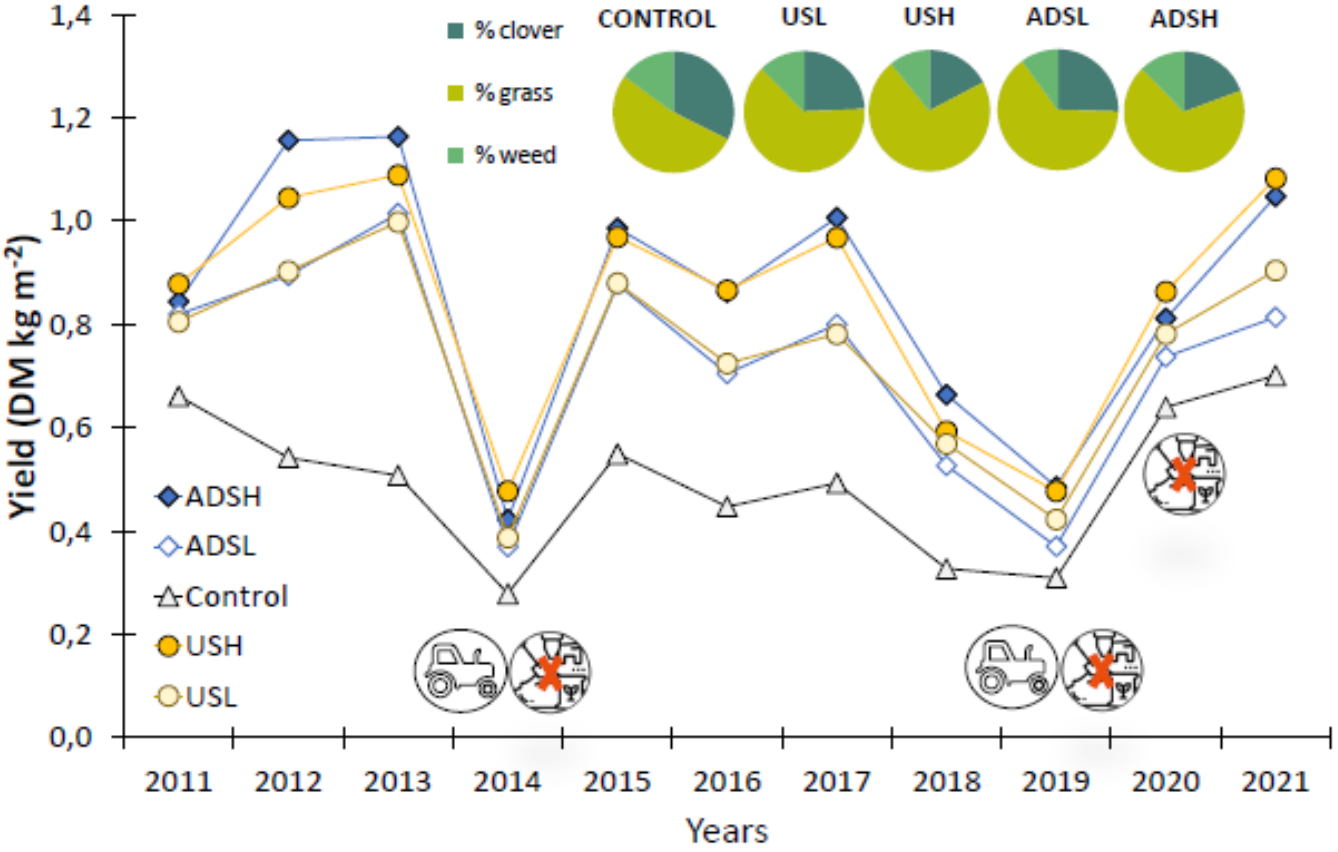
soil effects

NORSØK
Norwegian Centre for Organic Agriculture

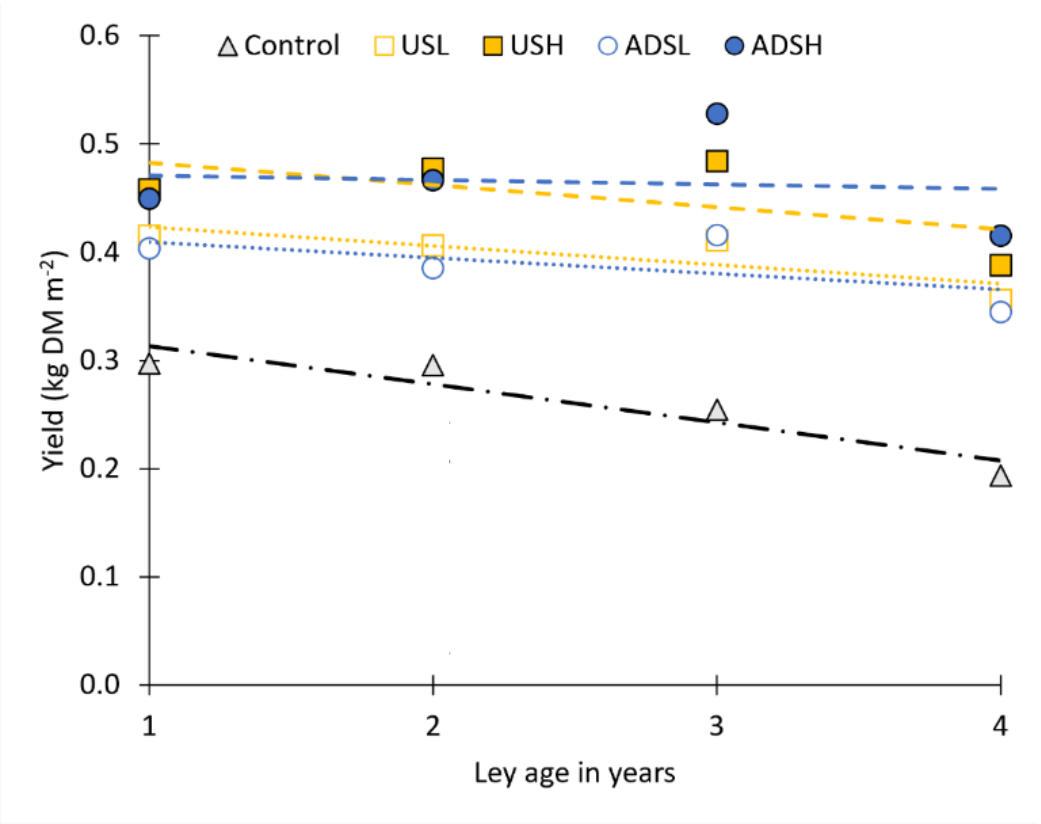
Yield

Rotation : 4 yr ley + 1 yr green fodder with re-establishiment of ley
2 harvest: June and August

Yield

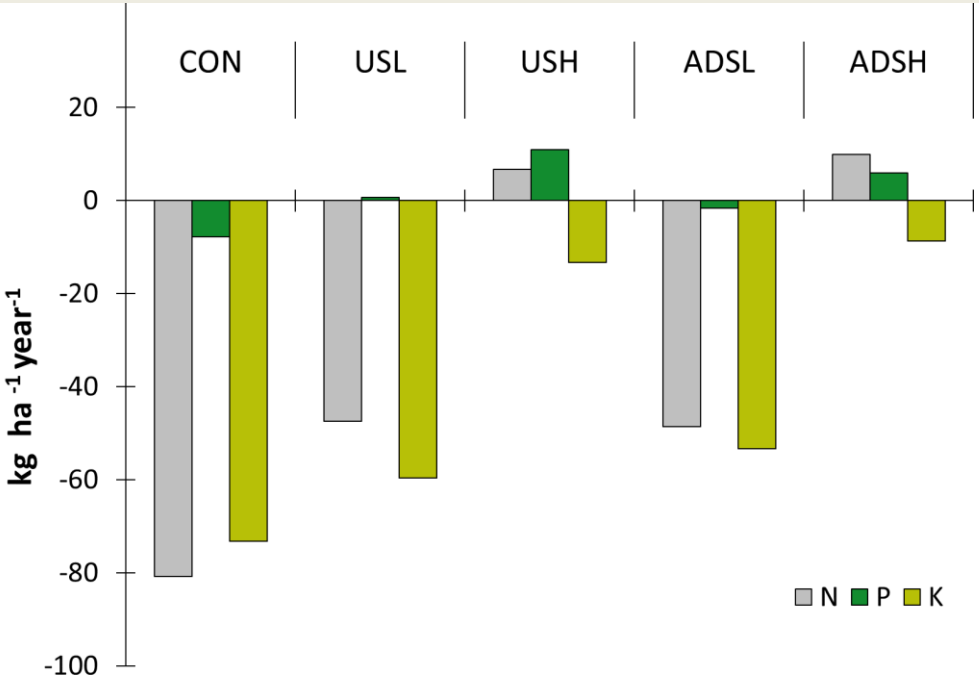

CONTROL
USL
USH
ADSL
ADSH
% clover
% grass
% weed
Yield (DM kg m-2)
1,4
1,2
1,0
0,8
0,6
0,4
0,2
0,0
ADSH
ADSL
Control
USH
USL
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Years

Yields of the ley



Nutrient budgets (2011-2021)

Nutrient budget = INPUT (fertilizer) – OUTPUT (yield)



Rittl et al. (under revision)

soil effects

NORSØK Norwegian Centre for Organic Agriculture

Conclusions

✓The effect of US and ADS on SOM, soil fertility and crop yield are similar, despite their initial differences.

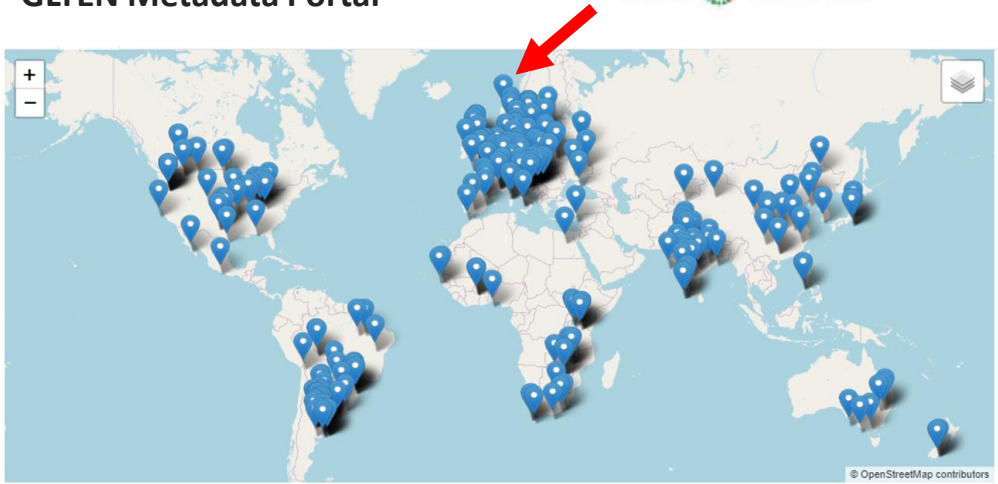
✓Long-term application of US and ADS did not increase or even maintain the SOM content in the soil top layer.

✓Long-term application of high and low rates of ADS and US, maintained yields but at different levels; the yields were on average 17% higher by a double application of manure.

Thank you!

Tatiana Rittl
tatiana.rittl@norsok.no

GLTEN Metadata Portal



More info:

https://www.norsok.no/

https://www.youtube.com/channel/UCyq6x7OFN83nlPP9518OoDg/videos