The value of manure and digestates as fertilizer

How does the biogas treatment effect the fertilization value?

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Foto: Torkild Birkmose, SEGES

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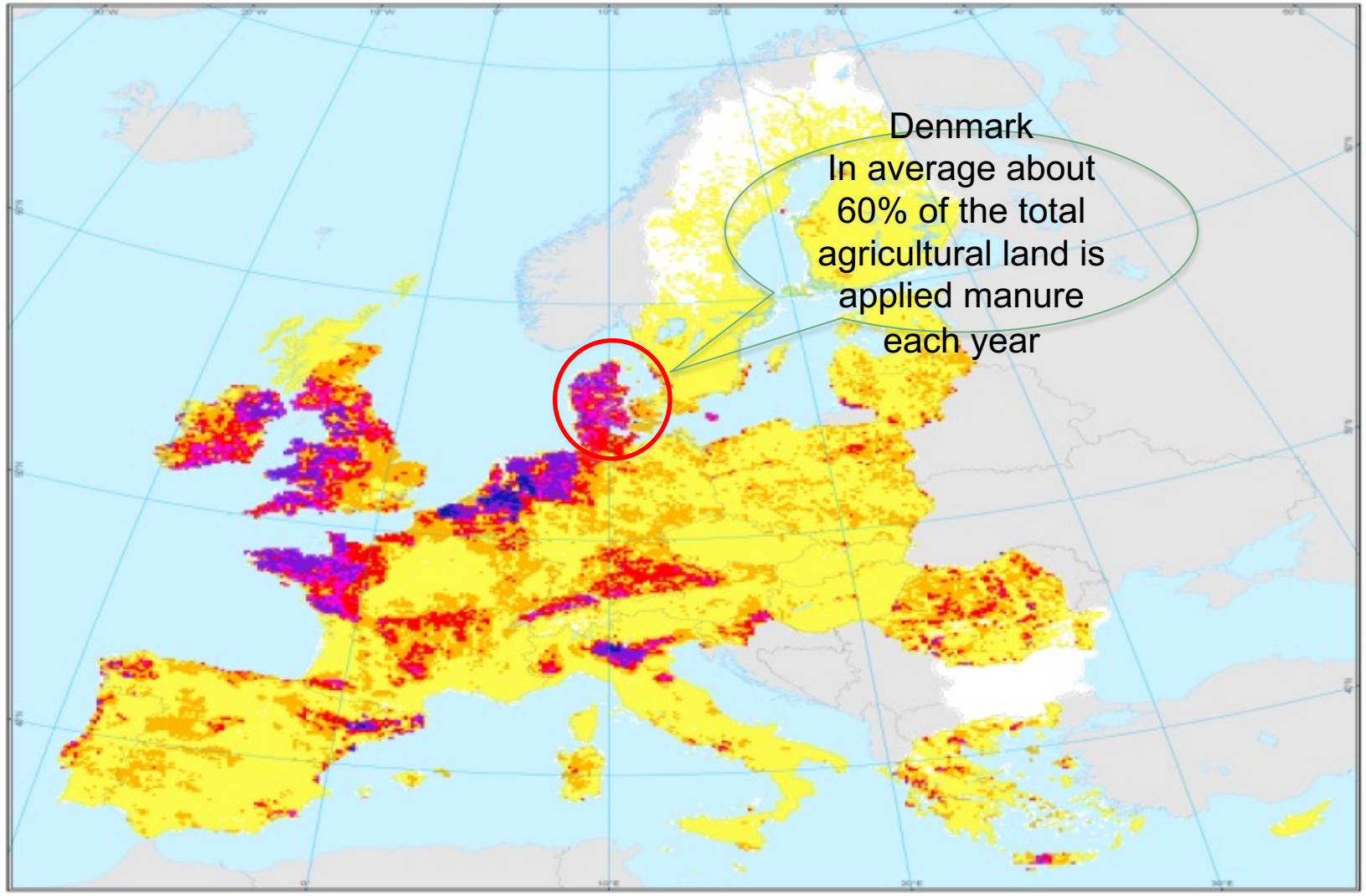
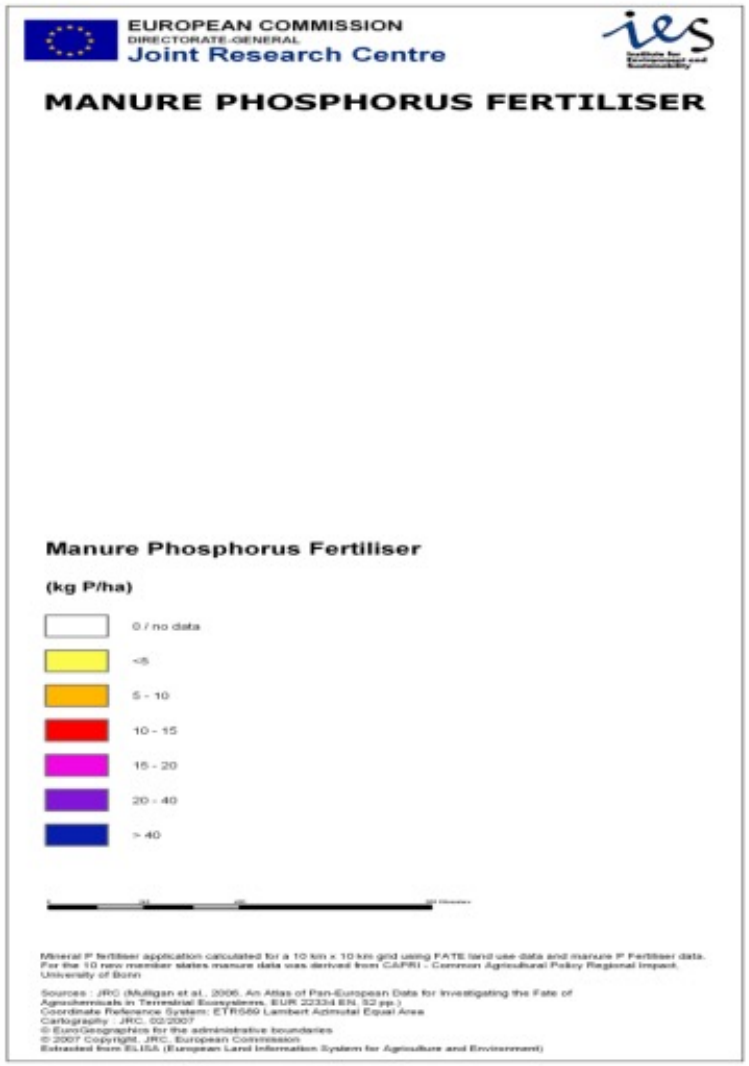
Manure and digestates meeting
Webinar, REMO 24.03.2022

Denmark has a lot of livestocks – and manure





Optimal utilisation of manure =
- optimal recirculation of nutrients
- reduction of loss and environmental impact

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Optimal utilisation of manure =
- optimal recirculation of nutrients
- reduction of loss and environmental impact
Biogas production has become more and more important

Other organic biomasses

27 %

73 %

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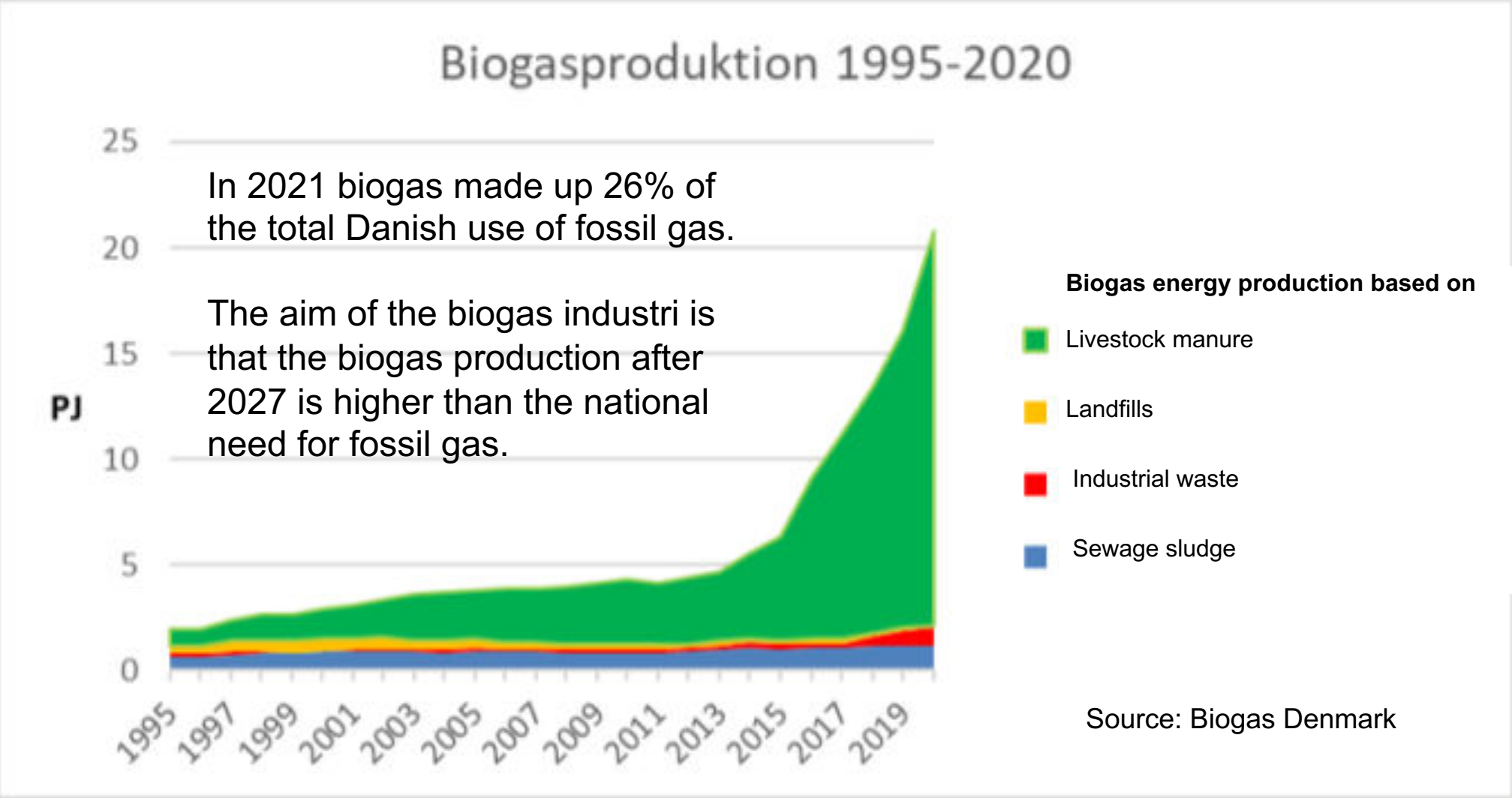
Development in energy production at Danish biogas plants, 1995 - 2020



Source: Biogas Denmark

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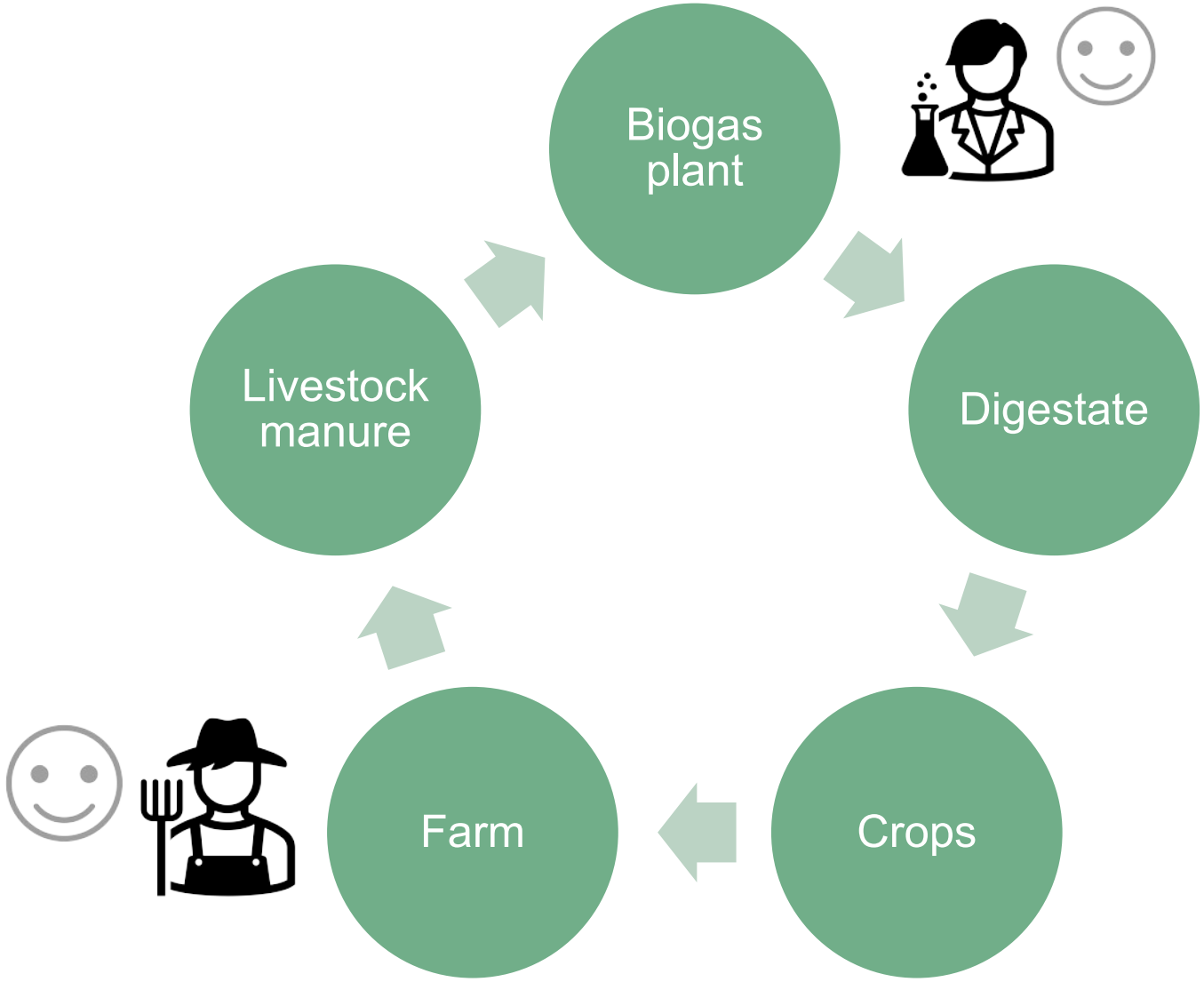
A happy farmer is a prerequisite for manure delivery, and for distribution of digestate



- The farmers' livestock are requested as supplier of livestock manure
- The farmers' fields are requested for application of digestates

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What is important for farmers who deliver manure, and receive digestates from a biogas plant?

- Reduction of odour nuisances 
- Knowledge of the actual nutrient content
- Elimination of pathogens, weed seeds and parasites
- Reduction of greenhouse gas emission
- Higher fertilization value of digestates

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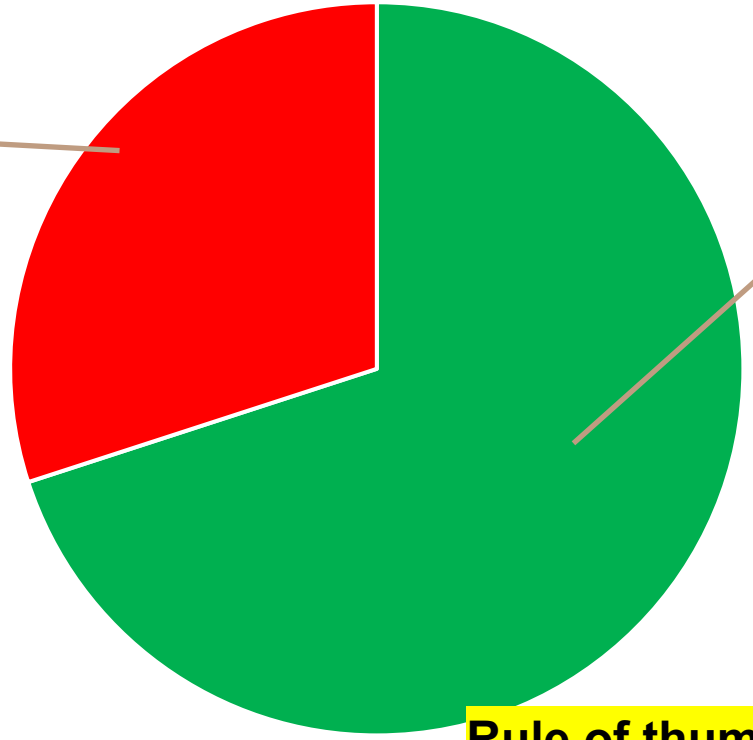
The higher the ratio of NH_4-N, the better

Digested cattle slurry

Organic N

- Has to be mineralized before it can be utilized by plants
- Has a low fertilizer effect



Ammonium N (NH_4-N)

- Is readily plant available nitrogen
- Is taken up and utilized similar as N in mineral fertilizer
- Has a high fertilizer effect

Rule of thumb

The ratio of NH_4-N is equal to the mineral fertilizer equivalent.

This means that application of 100 kg N in a slurry with a NH_4-N ratio equal to 70% can replace 70 kg of mineral fertilizer N

How does the biogas process affect the fertilizer value of slurry?

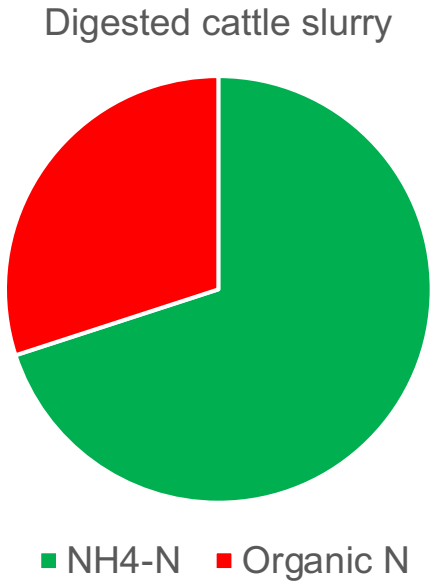
Cattle slurry

Biogas plant

Digested slurry

Anarobic digestion of livestock slurry

- Increases the ratio of NH_4-N
- Reduces the dry matter content
- Increases slurry pH



The input of other organic by-products influences the composition of the digested slurry, and therefore its fertilization value.

Pig and cattle slurry

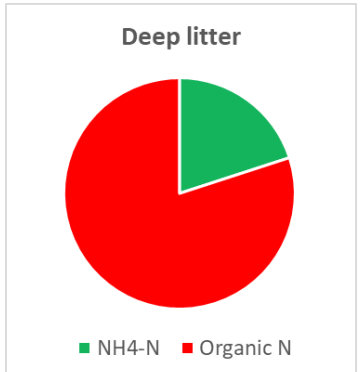
Other biomasses

Digested slurry

Types of organic by-products

- Industrial: By-products/commodities from agriculture, feed industry, households etc.

- Agricultural by-products/waste products (Have in general a high dry matter content, and low nutrient value and content)
  - Deep litter
  - Crop residues
  - Energy crops
  - Straw
  - Catch crops, etc.

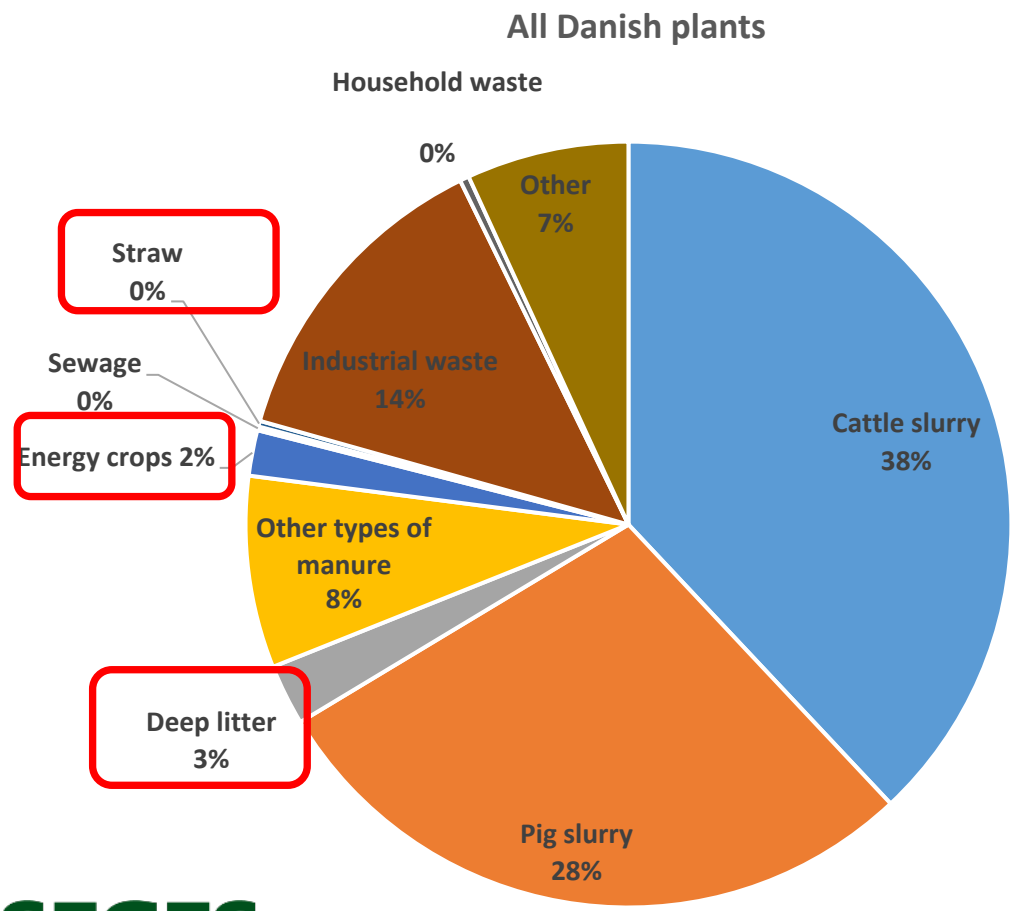


Inputs of agricultural by-products (in general)

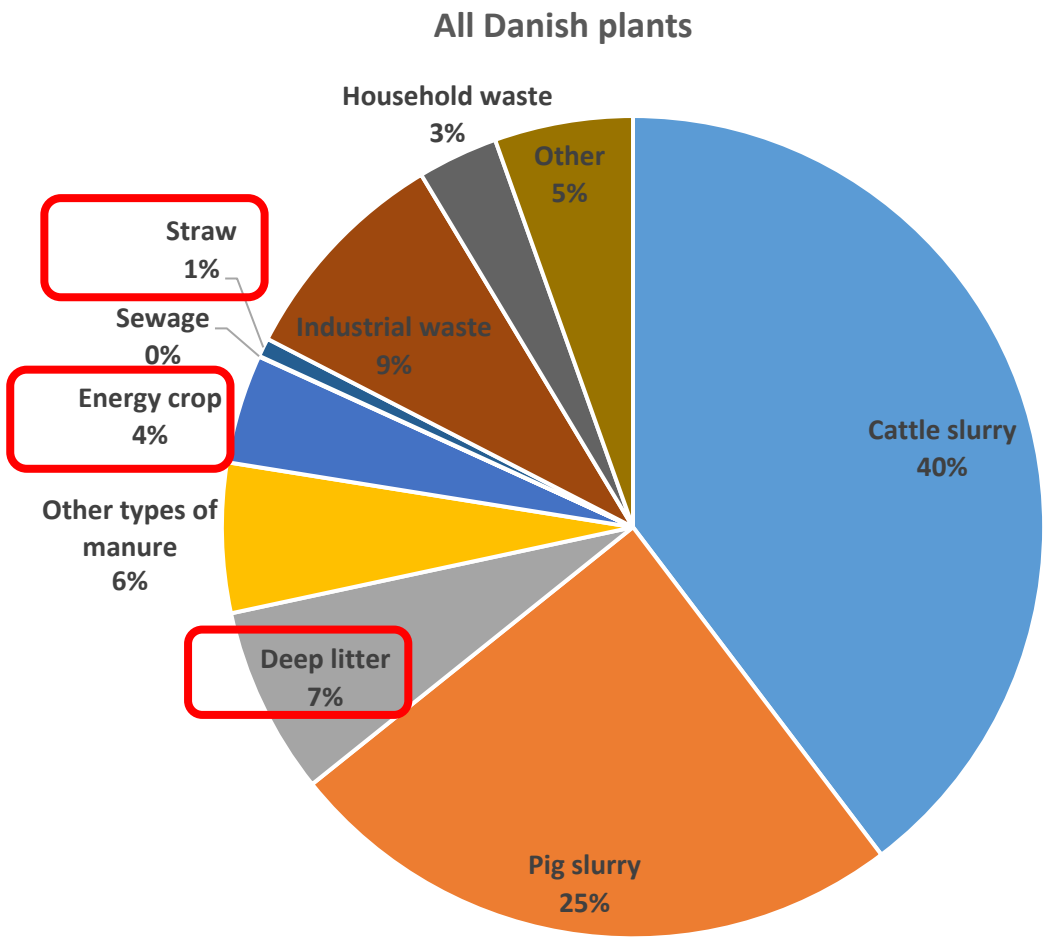
- Increases the dry matter content
- Decreases the ratio of NH_4-N

Deep litter, straw and energy crops makes up an increasing share of the biomasses at biogas plants

2015-2016



2020-2021



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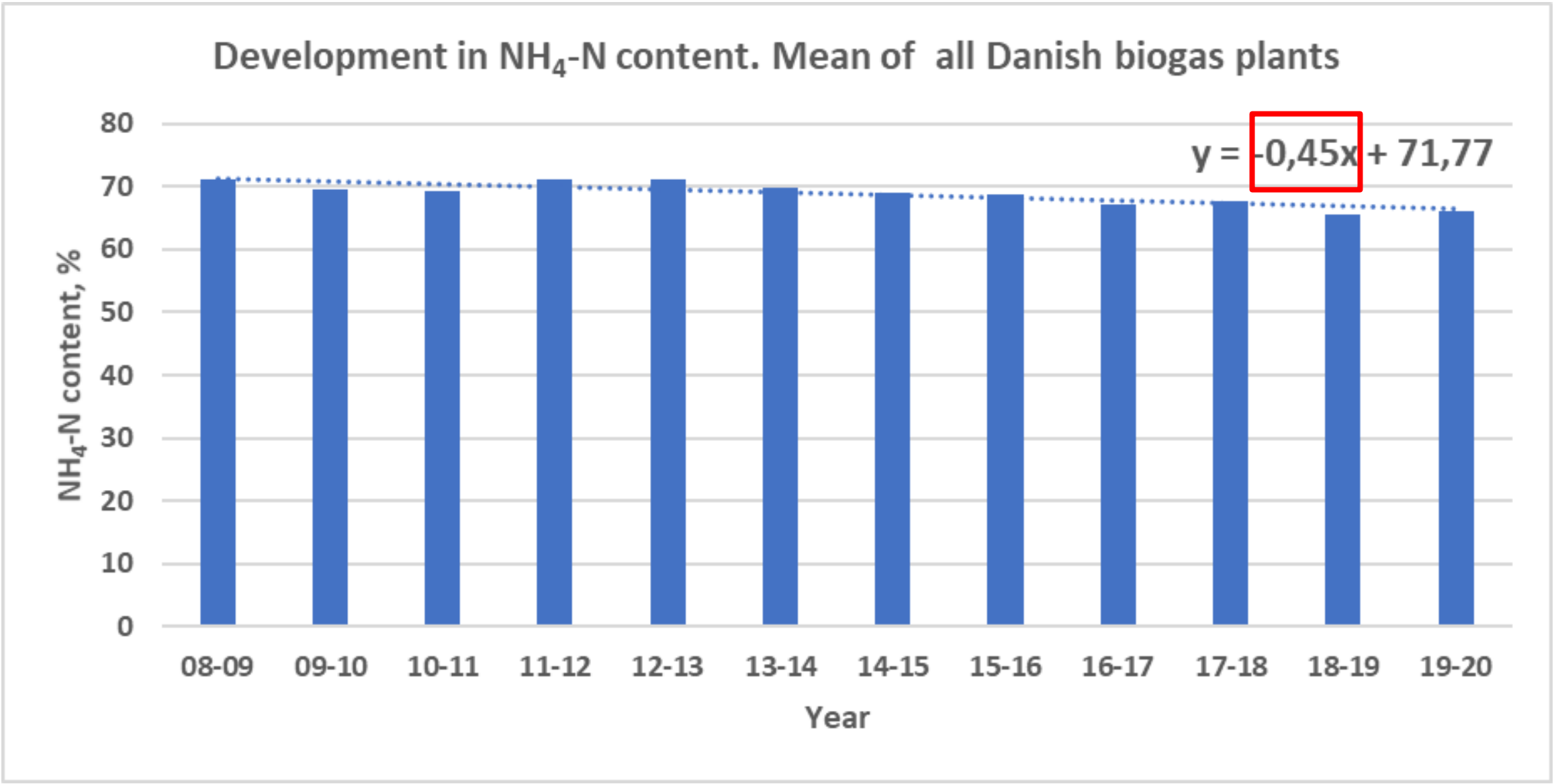
Source: SEGES, 2021

Higher input of biomasses of low ”nutrient value” has decreased the NH_4-N content of Danish biogas slurry



Effects of input of biomasses with a high dry matter content

The lower the dry matter content, the better

Slurry

– high dry matter content

Slurry

– low dry matter content

Higher dry matter content increase the nitrogen emission loss in form of ammonia N

There may be a need for separation of digestates to reduce the dry matter content of the digestates

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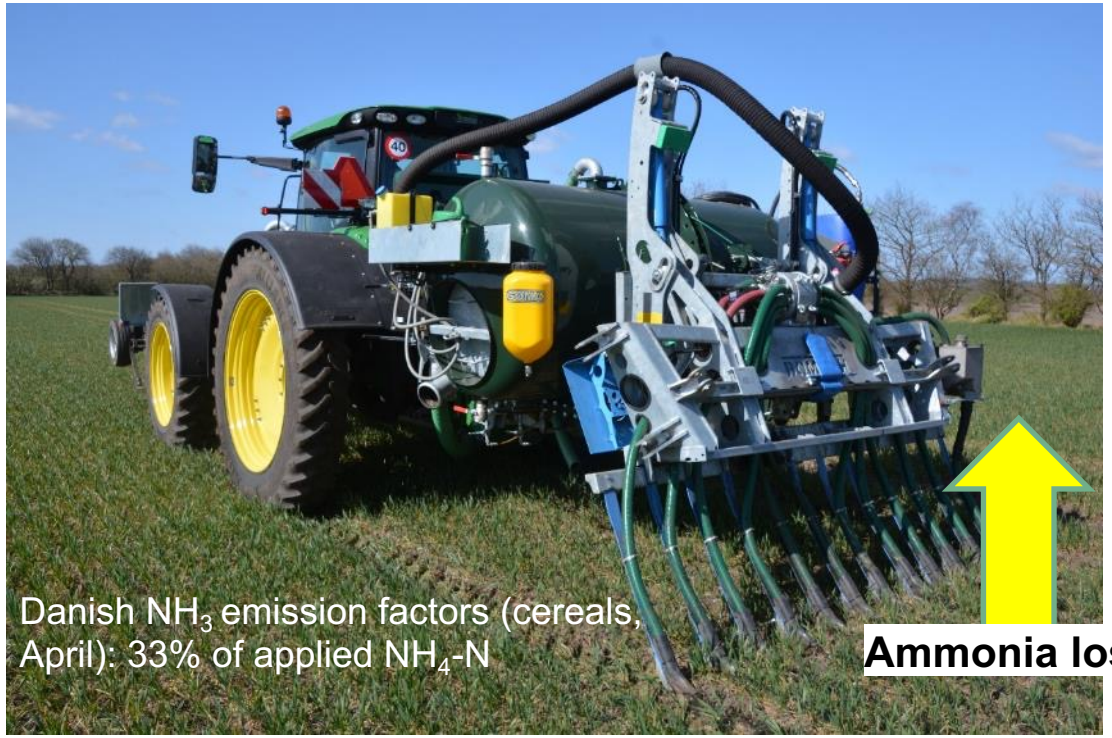
Higher pH and dry matter content in digested slurry increases the potential for ammonia loss

Cattle slurry

Digested slurry



The higher the ammonia loss, the lower the fertilization value – the risk of ammonia loss can be reduced by ammonia abatement technologies

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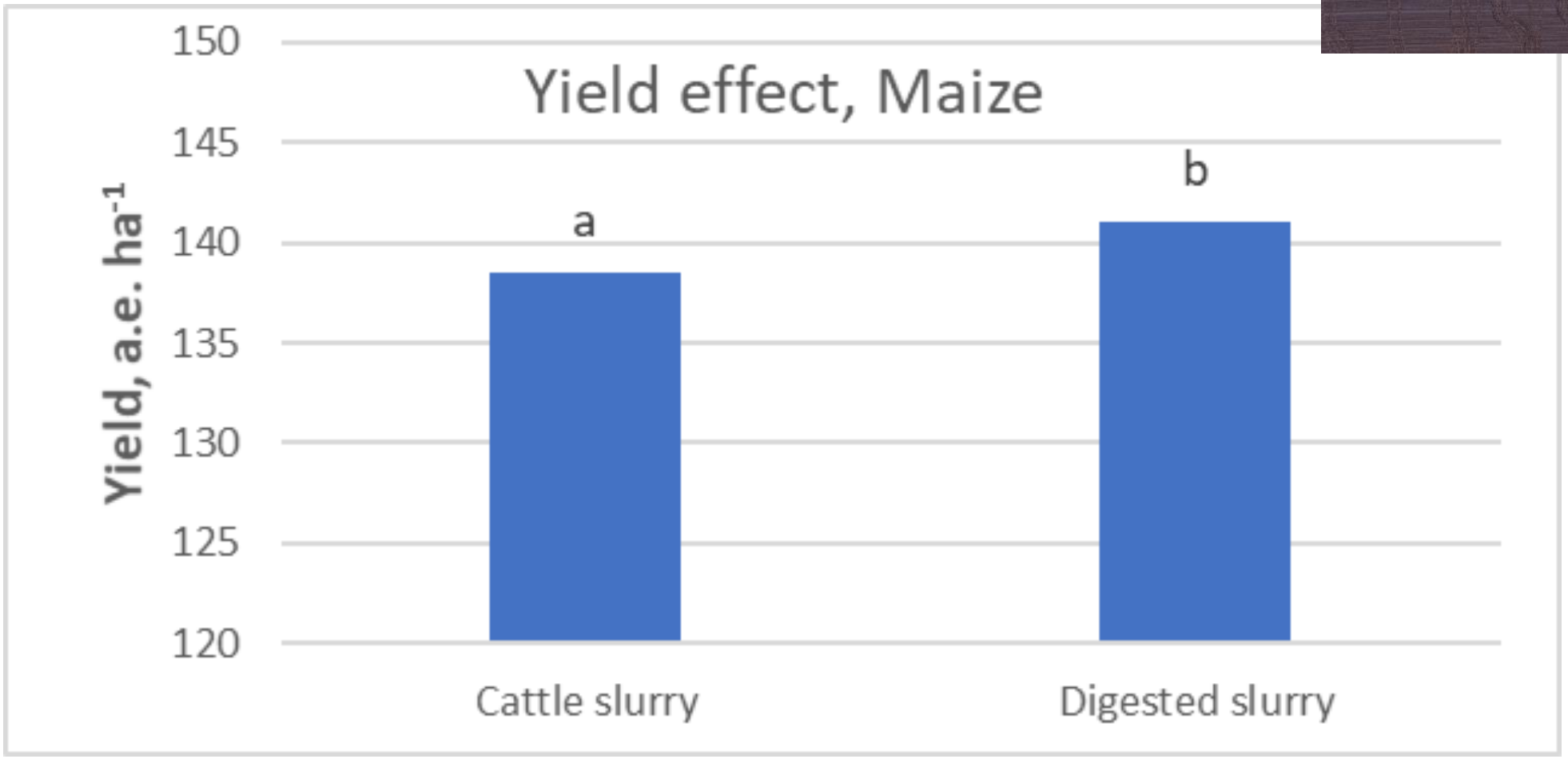
Digested slurry is still an attractive fertiliser

Yield of fodder maize fertilised the same amount of NH_4-N in injected cattle slurry and digested slurry.
10 field trials in 2020 and 2021.



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Summing up

- Biogas production is an important part of the green transition of both energy and agricultural production
- Biogas plants are depending on farmers that will deliver biomass, and take back the digestate
- The interest of farmers to cooperate with a biogas plant is depending on the quality of digestates
- The fertilization quality of livestock slurry is improved by the biogas process
- But be aware that high inputs of biomasses with a low content of readily available nitrogen may counteract the benefits of the digestion process

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Thank you for your attention!

Foto: Torkild Birkmose, SEGES