

# How to mitigate methane and ammonia emissions at the farm level with innovative approaches

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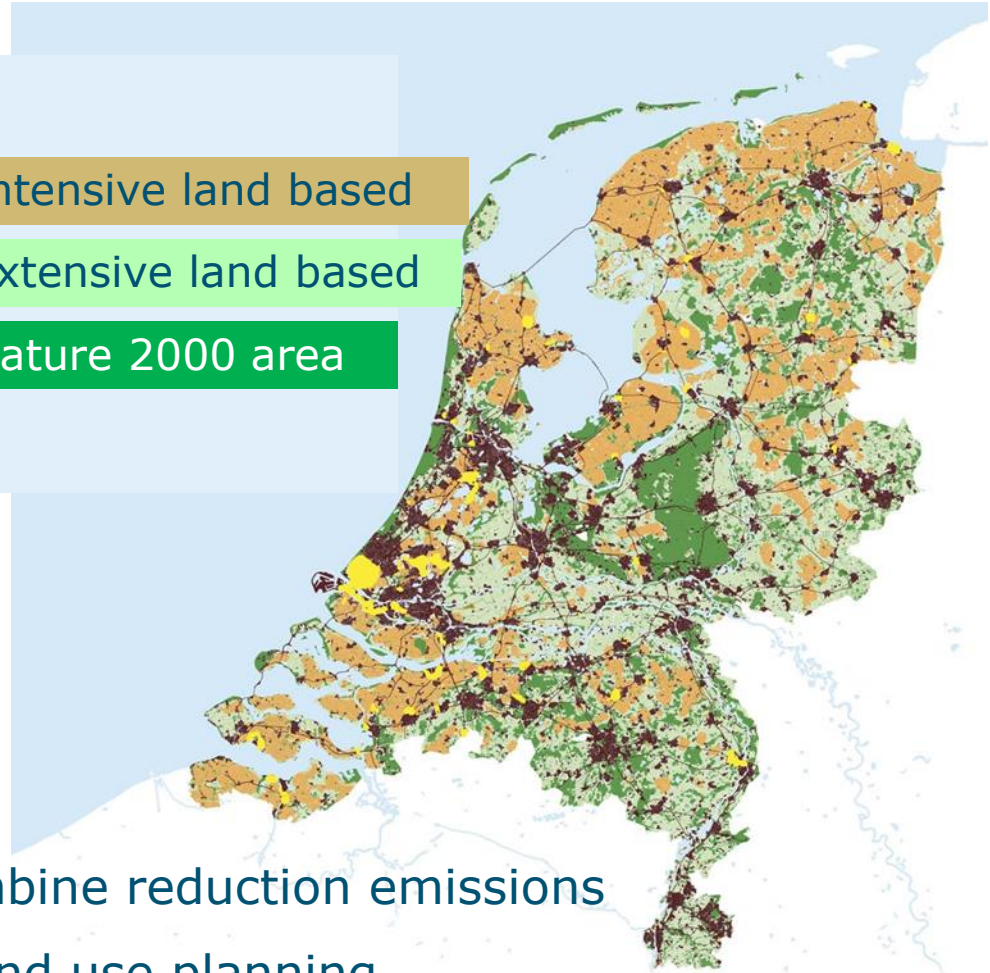
# Farming in the backyard of 18 M people



Intensive land based

Extensive land based

Nature 2000 area

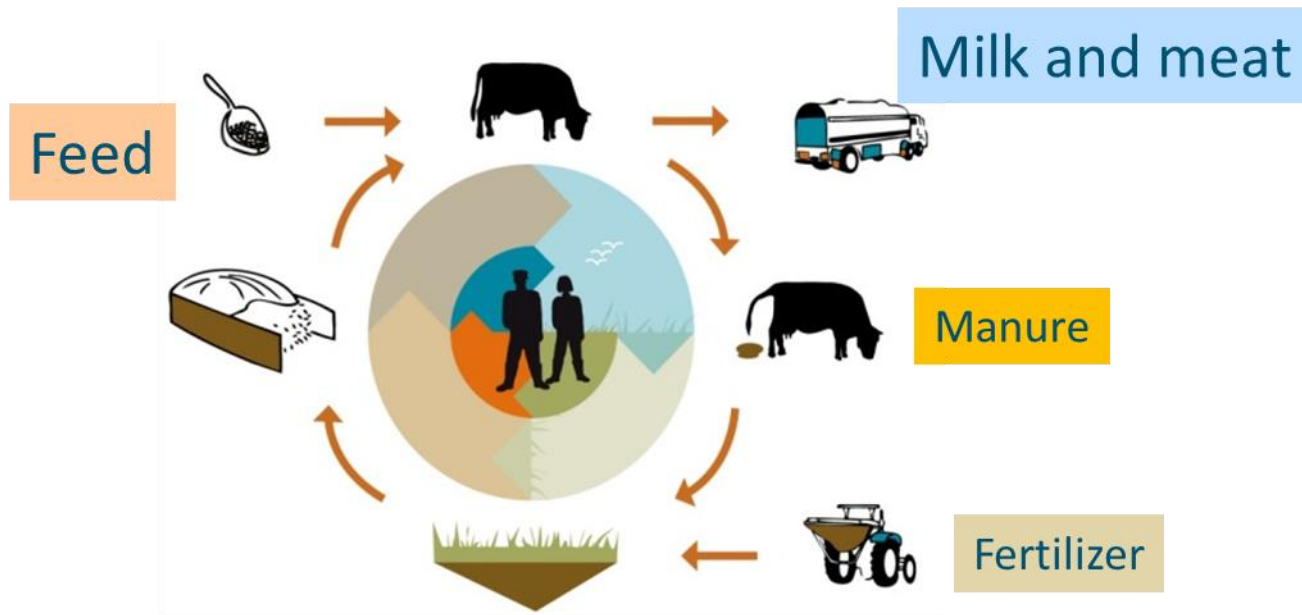


Challenge to combine reduction emissions  
with land use planning

# Topics

1. Optimize nutriënt cycle with ANCA tool
2. Reduction potential NH<sub>3</sub> and CH<sub>4</sub>
3. Research topics, innovations

# Optimize nutrient cycle with ANCA tool (Annual Nutrient Cycle Assessment)



Soil-, crop-, grassland- and  
grazing management

# ANCA tool on farm level

## Annual Nutriënt Cycling Assessment



Gives insight in:

- NPC efficiency in parts of cycle
- Crop production
- Pollution soil, air and water





# Learning networks

## Integrated approach:

- Emissions NH<sub>3</sub> and GHG
- Water quality
- Biodiversity



153 dairy farmers and 45 farm guiders 4 years

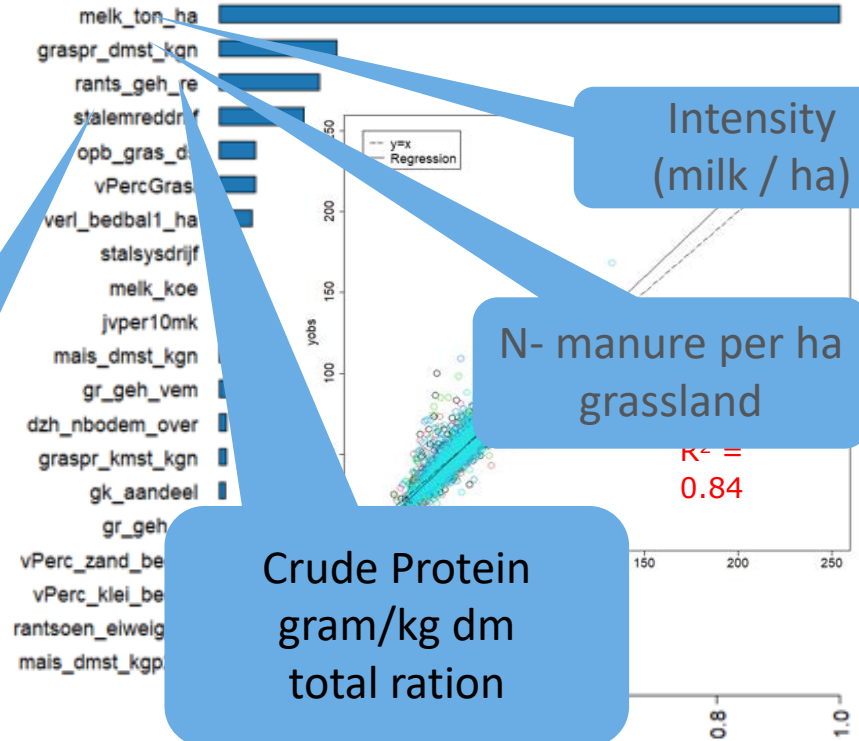
Goal: 155 gram Crude protein per kg dry matter



# Explanation ammonia emission per ha

- Data 2021 ANCA tool
- 12000 farms
- 47 variables
- Select most important

% emission reduction Stable





# Other important developments to reduce ammonia

More grazing

Dilution with water

Low emissions floors

Total 50 to 70% reduction



# Reduction potential Methane (CH<sub>4</sub>)

Goal: 24% less CH<sub>4</sub> on Dairy farm in 2030 (ref. 2021)



Source: WUR 2022  
Vellinga, Groenestein  
in prep.

## Scenario Reduction

### Manure management

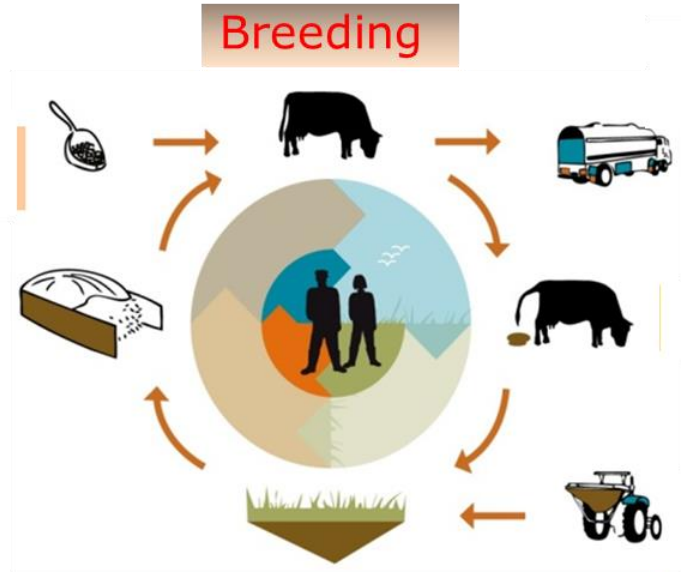
* cool slurry	40 – 80%
* oxidation	60 – 90%
* digest	45 – 95%
* more grazing	10 – 35%

### Rumen cow

* breeding	0.2–0.7% Per year
* additives	20-30%
* ration	0-10%

# Research topics to reduce NH<sub>3</sub> and CH<sub>4</sub>

**Feeding:**  
Less protein  
Amount of maize  
Additives



**Stable:**  
spraying water on floor  
fast remove slurry  
separation feces and urine  
clean air

**Grassland and grazing:**  
hours grazing  
feeding fresh grass  
Manure application techniques

**Manure:**  
additives  
cooling  
catch CH<sub>4</sub>



# Dairy Campus

## Detailed research:

Feeding

Emissions

Grassland management

Breeding

Welfare

Biodiversity

## Farm:

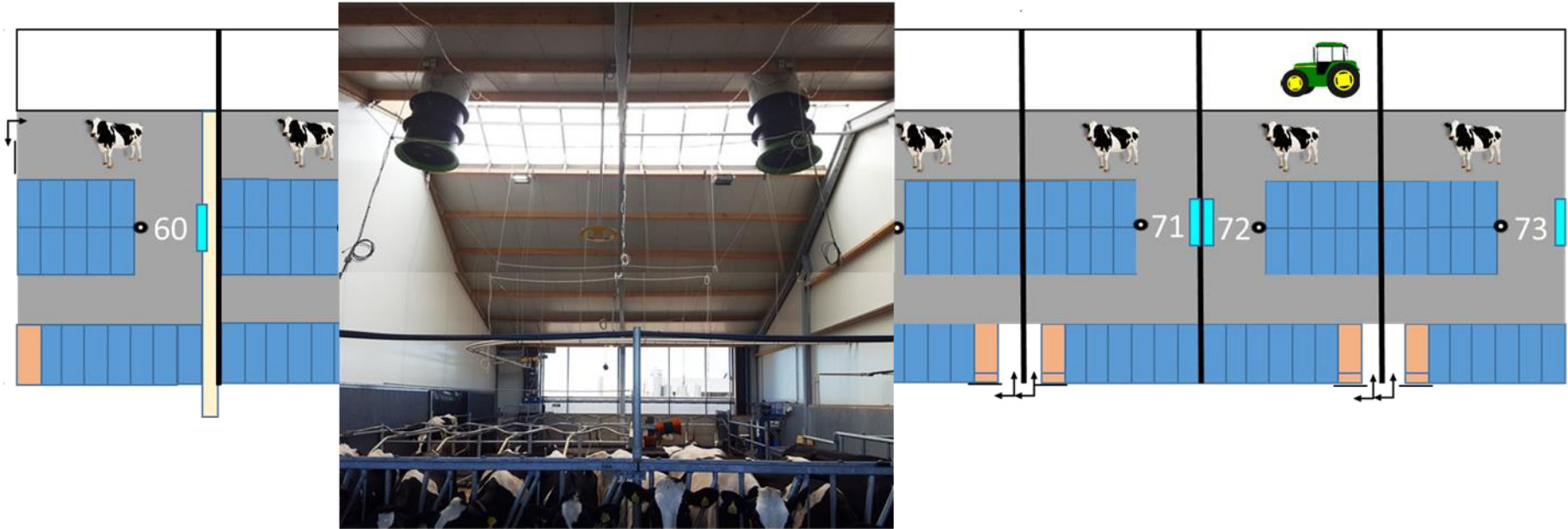
500 cows

350 ha

25 fte



# Dairy Campus: case – control units of each 16 cows



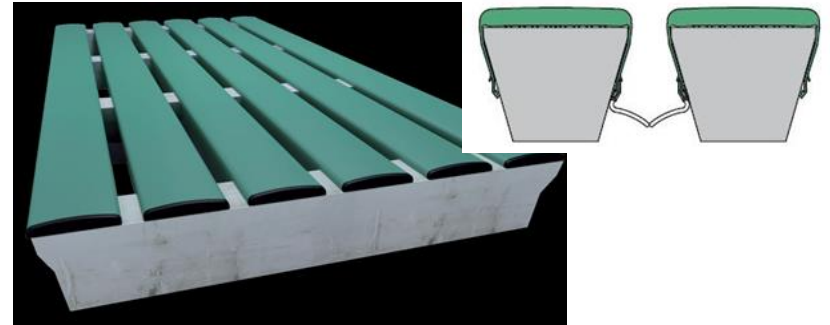
# Examples floor types in practice



Swaans concrete floor G6



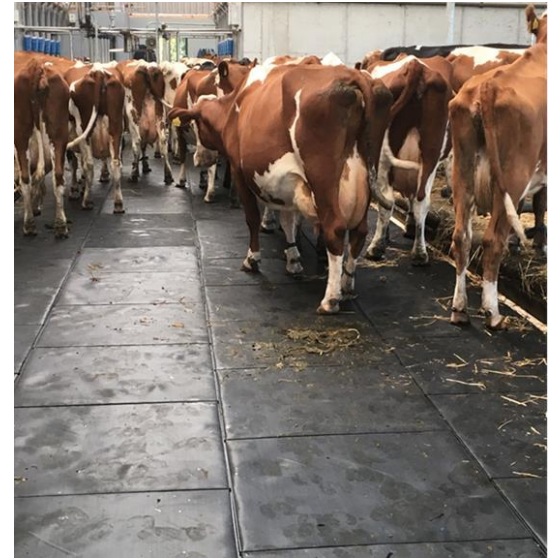
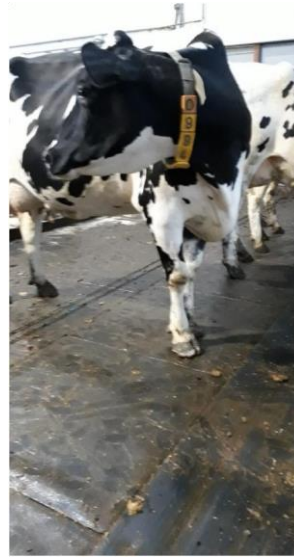
Proflex Meadow



Green flag floor with flaps



# New permeable floor type



40 to 60% reduction ammonia emission:

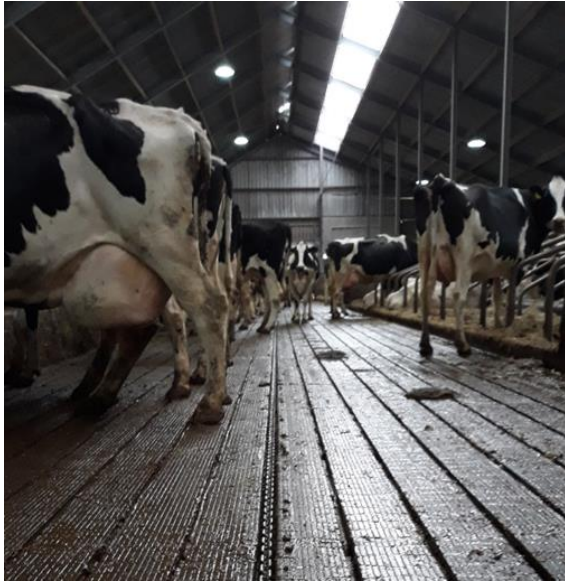
- spraying water and adding urease inhibitor
- adding acid to urine: reduces  $\text{NH}_3$  and  $\text{CH}_4$

# CowToilet separates 35% of urine production





# Examples remove slurry or feces from stall for storage in covered silo or digesting



Separation feces and urine



Bedding cleaner picks up feces  
and organic material for digester  
in freewalk housing system



# Freewalk housing with bedding cleaner



Sand bedding to separate urine

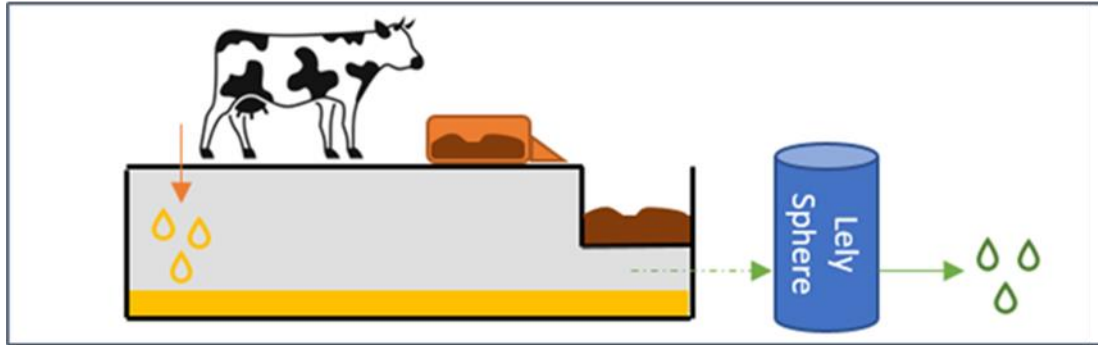


Lely sphere

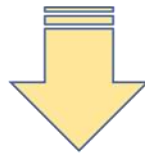
Network of farmers in preparation

# Lely Sphere: more than 75% reduction ammonia stall

## 3 manure products



Liquid (K)



Solid (P)



Ammonium Sulphate (N)

Air suction



# Cooling manure



Cooling manure in barn  
with cold water / glycol

- Goal:  $< 8-10\text{ }^{\circ}\text{C}$
- Result cooling:  $8.9\text{ }^{\circ}\text{C}$ , not cooling  $13.4\text{ }^{\circ}\text{C}$
- In august/september 7 to  $9\text{ }^{\circ}\text{C}$  difference
- Indication reduction:  
Methane: - 43%  
Ammonia: + 5%

Next step: cooling outside barn



# Attention points

1. Increasing influence of society (emissions, welfare, biodiversity)
2. Integrate strategies to reduce GHG and ammonia
3. Innovate what fits to your climate and housing system:
  - management: cow, feeding, crops, grazing, fertilizing, ...
  - investments: housing, manure management, ....
4. Optimize on farm level by use of a nutriënt cycle tool and sensor technology

Thanks

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