INTEGRATED MANURE MANAGEMENT SYSTEM:

IMPROVING FERTILISING PROPERTIES AND REDUCTION OF EMISSIONS FROM DAIRY EXCREMENTS BY NOVEL MANURE MANAGEMENT STRATEGIES

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Introduction and Objective

Introduction:
The current dairy manure management strategies still result in losses to the environment causing serious impacts (climate change, eutrophication, acidification). One reason is that the interactions between these strategies in the chain are limitedly considered.

A more **holistic management approach** (animal house to plant uptake) using complementary measures was designed, and model results showed that **greenhouse gases (GHG), ammonia (NH_3) emissions, and phosphorus (P) application excess could be reduced by at least 70%**.

Experimental verification of these predictions, however, is required to further develop such **integrated manure management systems** for application, which we propose to do in this research.

Objective: This work aims to **experimentally validate** the model-based hypothesis related to the potential **of integrated management systems** to **limit pollution swapping** in the manure management chain and **simultaneously: reduce NH_3, N_2O and CH_4 emissions and P excess application, improve plant nutrient availability, and minimize energy use**.

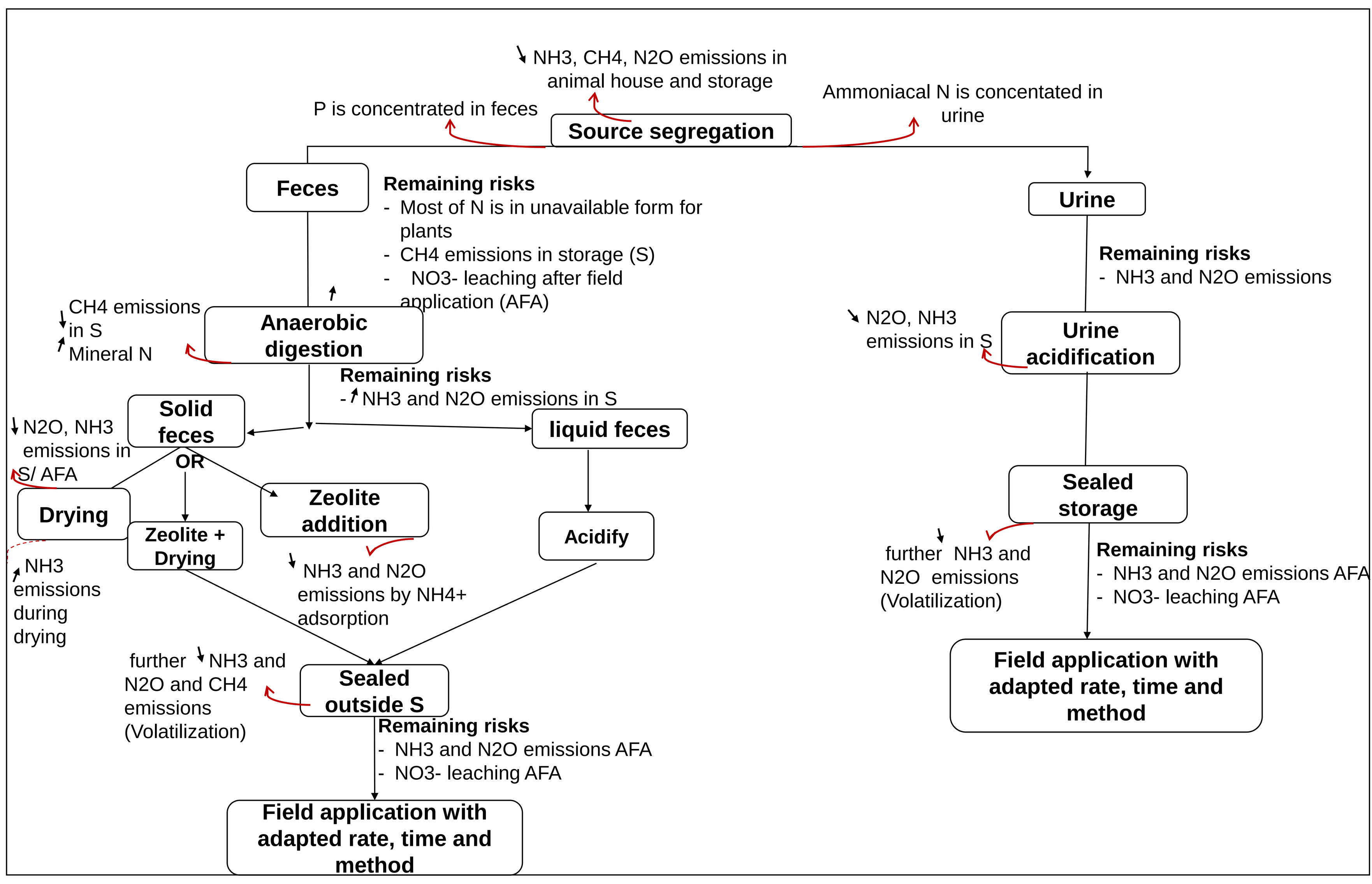

Figure 1: The design of the integrated system based on complementarity of measures. S: Storage, AFA: After field application. Note that managing faeces in the liquid form helps reduce N_2O emissions.

Materials & Methods

Permeable floor (PF) Rubber floor (RF)

Cow toilet (CT)

Figure 2: The three types of separation floors

Animal house

- Source segregated feces and urine (figure 2, Dairy Campus)
  - Three floor types: permeable, rubber, cow toilet
- Composition & separation eff.
- Collections: March, July & Dec

Processing

- **Anaerobic digestion** of slurry & feces (figure 3)
- **Acidification** of urine and liquid digestate (H_2SO_4)
- **Absorbent** (zeolite) and **drying** of digestate

Figure 3: Anaerobic digestion reactors

Sampling: of manures and plants before and after each step
Statistical analysis: Depending on the data appropriate univariate and multivarite analysis will be used

Storage

- **Conditions**: 10°C , 30 days, polyethylene sheet cover
- **Four replicates** for each fraction
- **Emissions**: dynamic chamber and photo-acoustic multi-gas analyser (figure 4)

Soil application

- **Soil profiles** from the field (intact)
- Conditions: greenhouse, **17 °C**
- **5 Treatments & 7 replicates**
- N and P plant uptake (figure 5)
- **6 weeks, two grass cuts**
- **Emissions**: dynamic chamber and photo-acoustic multi-gas analyzer

Overal assessment

- Of the **integrated systems**: emissions reduction, nutrients availability, and energy use => **Multivariate analysis**.
- **Life Cycle assessment (LCA)**

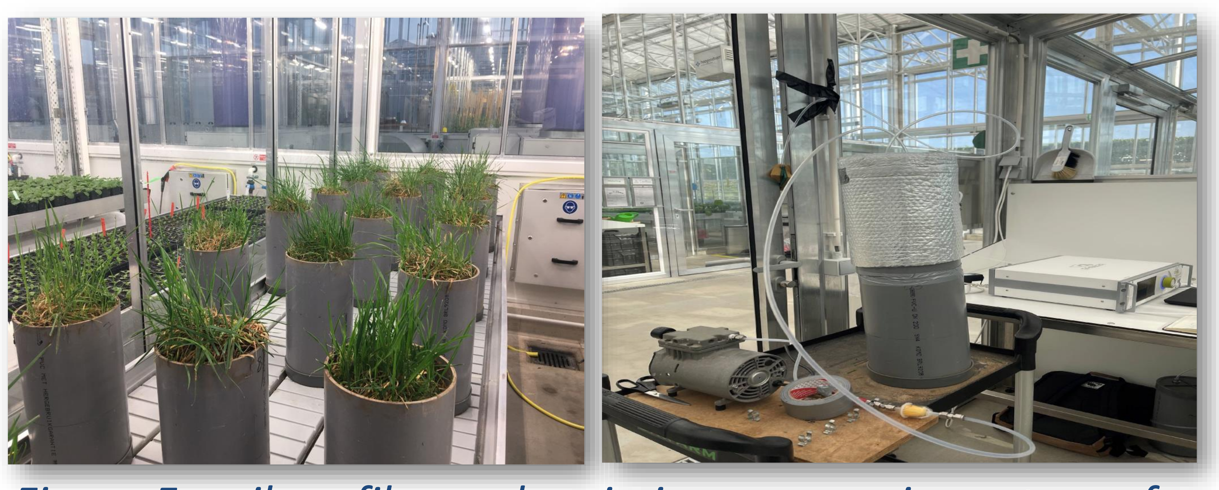

Figure 5: soil profiles and emissions measuring set-up of the soil application experiment

Figure 4: Emission measurement set-up storage experiment

Work added value

- Series of consecutive whole chain experiments on the same manure fractions will help better detect the changes and interactions between measures at different links of the chain.
- Starting with source segregated faeces and urine will separate nutrients at start and thus reduce processing needs, and make treatments more efficient.

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