

Biomass pre-treatment and optimisation of biogas operation parameters - Effects on the fertiliser value of the digestates



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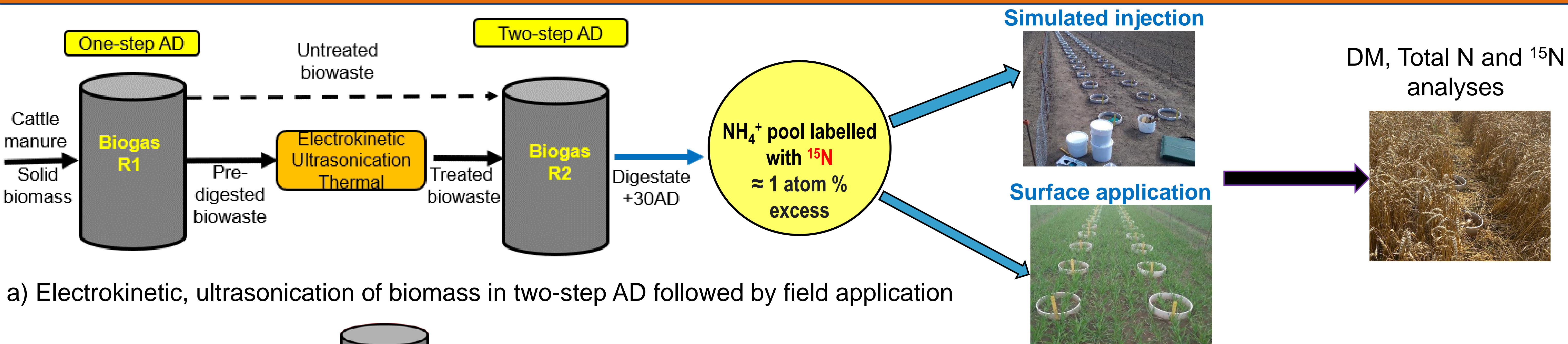
Introduction

- More than 30 % of manure is digested in Denmark
- Anaerobic digestion (AD) changes the **availability of nutrients** in digestates.
- There is a shift towards co-digestion of high dry matter recalcitrant biomasses such as **straw** and **deep litter** in biogas plants with manure for biogas.
- Results in partially decomposed organic matter and high dry matter digestates, which **negatively affects fertiliser value of digestates** and **increases ammonia losses** if surface applied.
- Need for an integrated approach to optimise AD process, where higher biogas yields and high concentrations of available nutrients in digestates are prioritised.

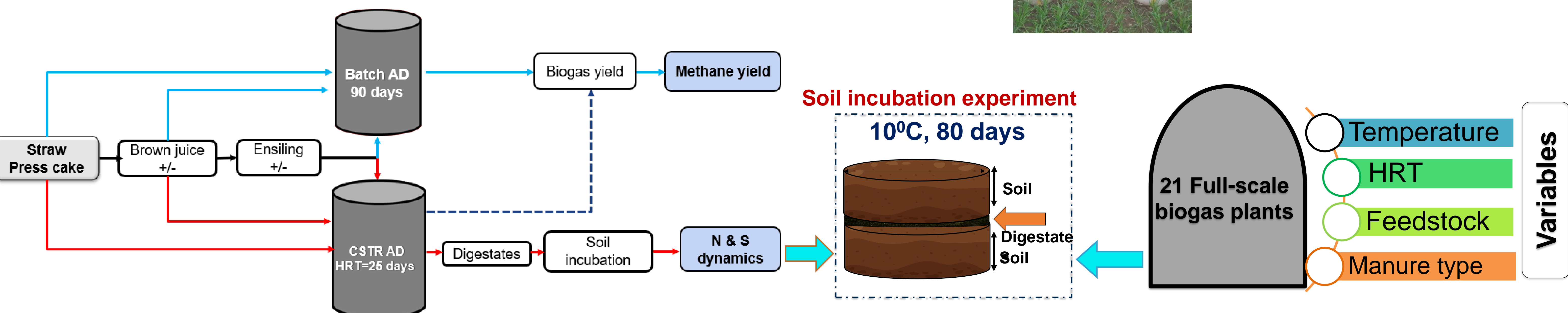
Objectives

- To evaluate how biomass pre-treatment techniques
 - ❖ Ultrasonication (US)
 - ❖ Electrokinetic (EK) and
 - ❖ Brown juice-assisted ensiling
 affect digestate nutrient availability and fertilising properties.
- Evaluate how biogas operation parameters and feedstock affect digestate nitrogen availability from full-scale biogas plants
 - ❖ Digestion temperature
 - ❖ Hydraulic retention time

Materials and Methods



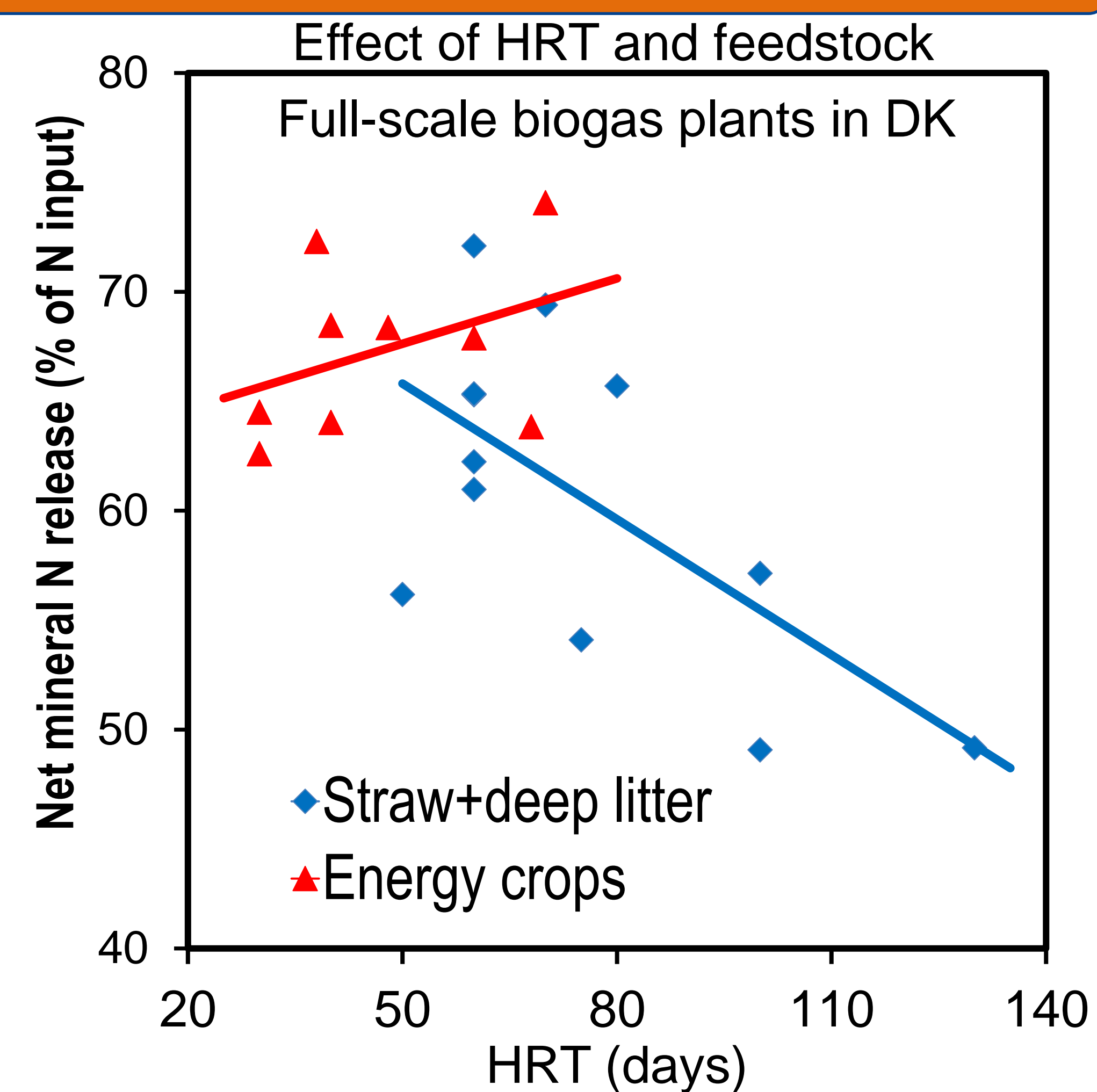
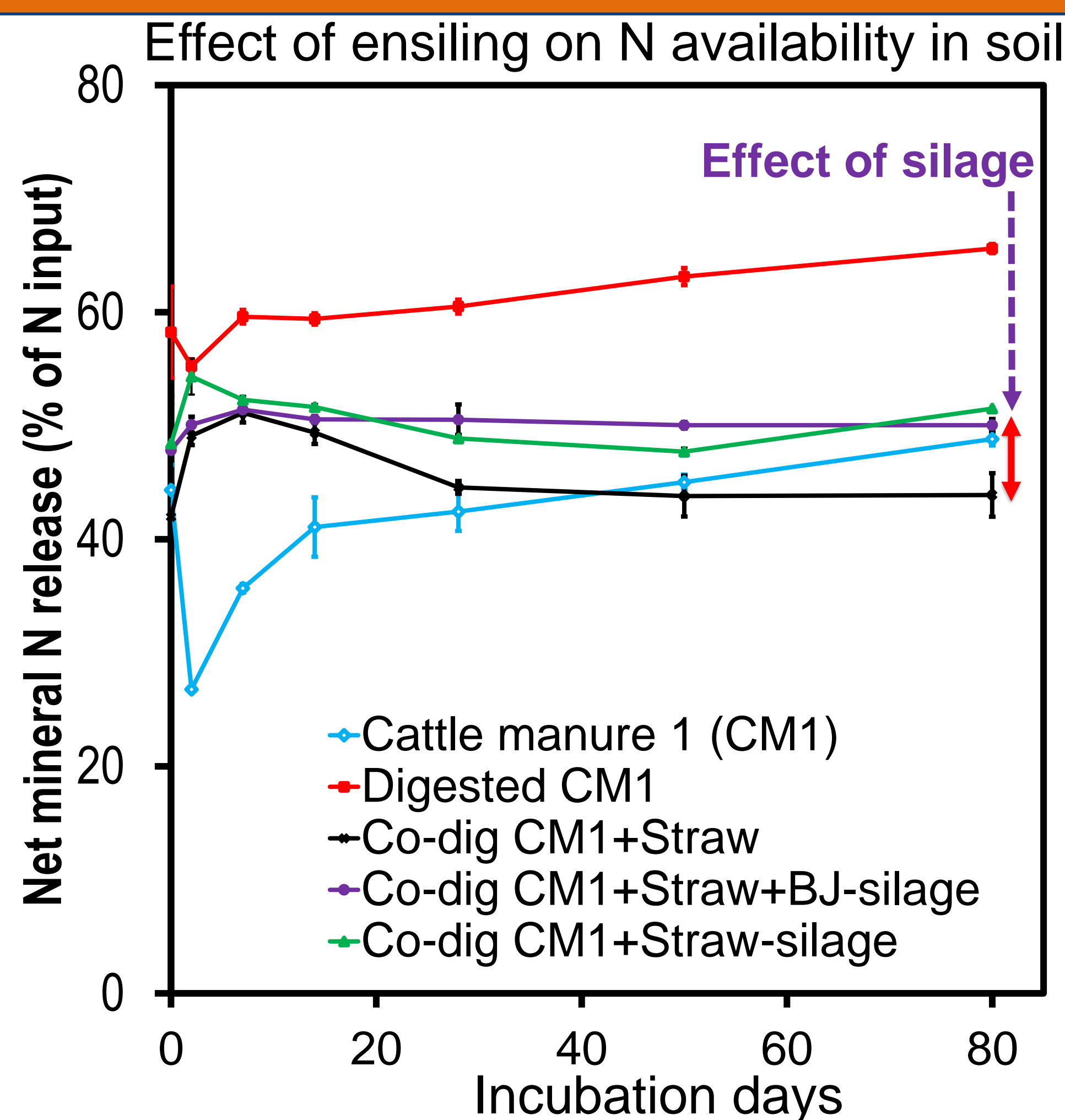
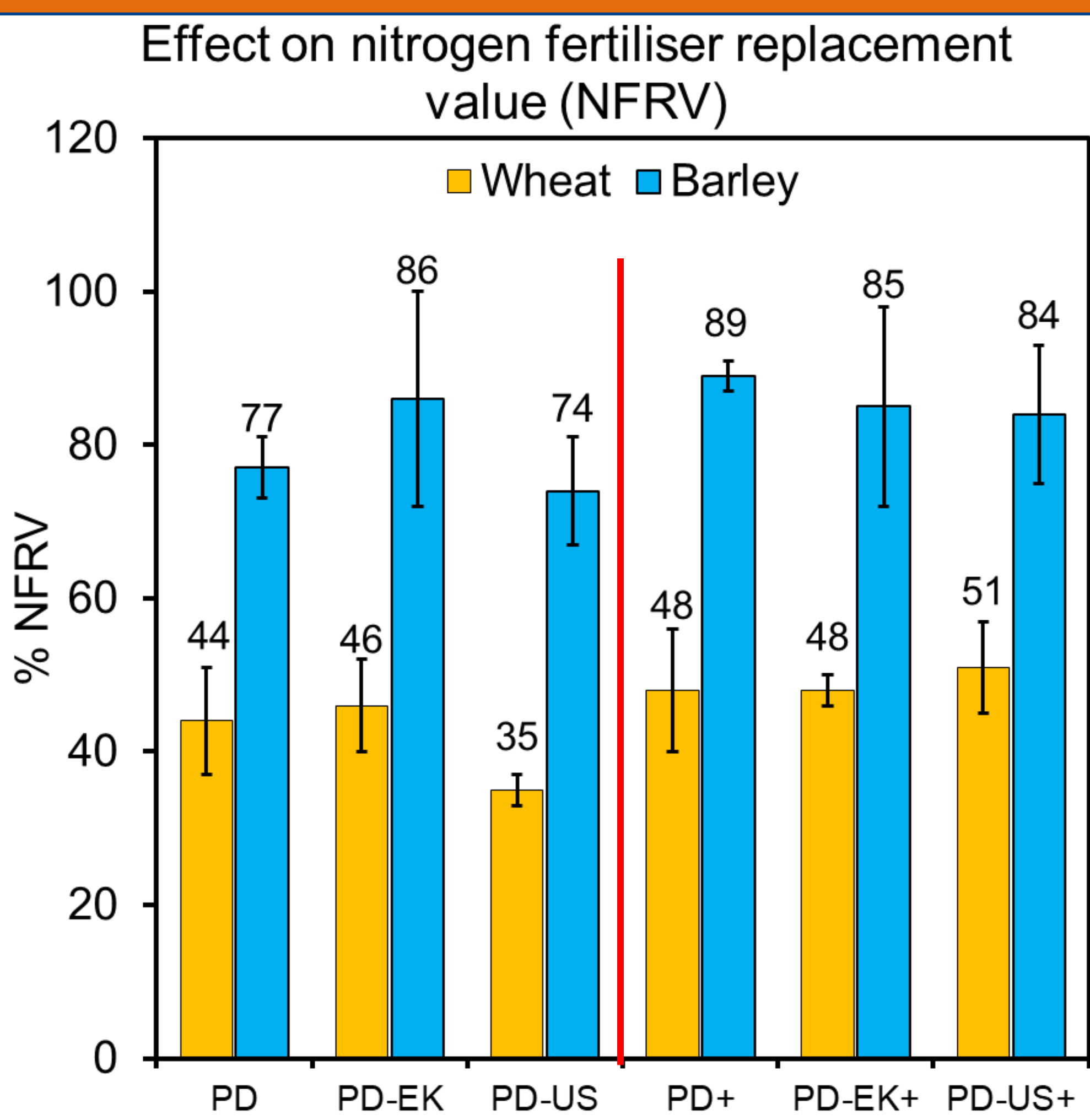
a) Electrokinetic, ultrasonication of biomass in two-step AD followed by field application



b) Brown juice assisted ensiling of biomass for anaerobic digestion

c) Effect of operation parameters of biogas plants

Results



Conclusions

- Pre-treatment of recalcitrant biomass prior to anaerobic digestion **does not** guarantee **higher N fertiliser value**.
- The choice of digestion **temperature** and **HRT** in the full-scale biogas reactors is greatly influenced by the feedstock type, and the effects of temperature and HRT are overshadowed by the feedstock type.
- Surface application of digestates results in **low fertiliser value** of digestates and **higher NH₃ loss**.
- Therefore, **solid-liquid separation**, **direct injection** and **acidification** of digestates are probably more effective strategies for improving the nitrogen fertiliser value of digestates.