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# Optimization of manure processing: Towards more sustainable manure-based fertilizers

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## Motivation

Organic matter supports many ecosystem functions vital for crop production and plays a central regulatory role in GHG-emission control and soil C sequestration[1]. Globally, soil organic matter, and thus C stores are increasingly depleted as a result of intensive farming practices, affecting both soil functionality and productivity. As a result, many ecosystem services are negatively impacted, such as water holding capacity, greenhouse gas (GHG) sequestration, and crop growth. Reintroduction of C into the soil system is often achieved by amendment with (treated) manure. However, current methods can lead to increased GHG-emissions and eutrophication, as treatment methods and application strategies are far from optimized[2,3]. In addition, the effect of the treated manures on the microbial, physical, and chemical characteristics of the soil are poorly understood. Steps are made to move from intensive agricultural practices to more regenerative agricultural practices, with the intention to maintain crop output whilst ameliorating soil health, also improving drought resilience.

Through optimization of manure (post and pre-)treatment technologies, nutrient mass balances can be tailored to the needs of the local soil. In essence this poses as a means of nutrient stewardship, which can improve ecosystem services[4]. As a result, fewer synthetic fertilizers may be necessary for agricultural practices. This can reduce costs, eutrophication and N emissions, whilst improving the soil status in terms of organic matter, aggregation properties, microbial diversity, and water holding capacity. Ultimately, this will make the soil more resilient against exogenous forcings and drought.

This research project aims to improve current manure treatment technologies by combining knowledge and integrating the frontier between bioprocess technology and soil science.

## Technological challenge

Manure digestion, and other (post- or pre-)treatments, can improve the sustainability of agricultural practices by allowing increased reintroduction of C and nutrients into the food chain[2,5]. However, the impact of such treatments in soil needs to be elucidated to achieve more effective amendment use. This calls for challenging data collection and analysis techniques, to determine among others[4,6]:

1. C uptake
2. GHG emissions
3. Nutrient leaching
4. C and N use efficiency (CUE/NUE)
5. Contribution of microbial C to SOM
6. Effect of organic input (and associated microorganisms) on soil microorganisms

## Research goals

1. Determine the differences in effects of various (post and pre-) treatments on physico-chemical and microbial properties of manure, as well as C and nutrient mass balance.

2. Assess the effect of treated manure and its stoichiometry on soil microbial communities looking at changes in the fate of C in soil, specifically OM stabilization and GHG-emissions.

3. Optimization of (post and pre-)treatments to reach tailored CNP balances with the right C quantity and quality.

4. Determine preliminary treatment strategies in relation to soil conditions.

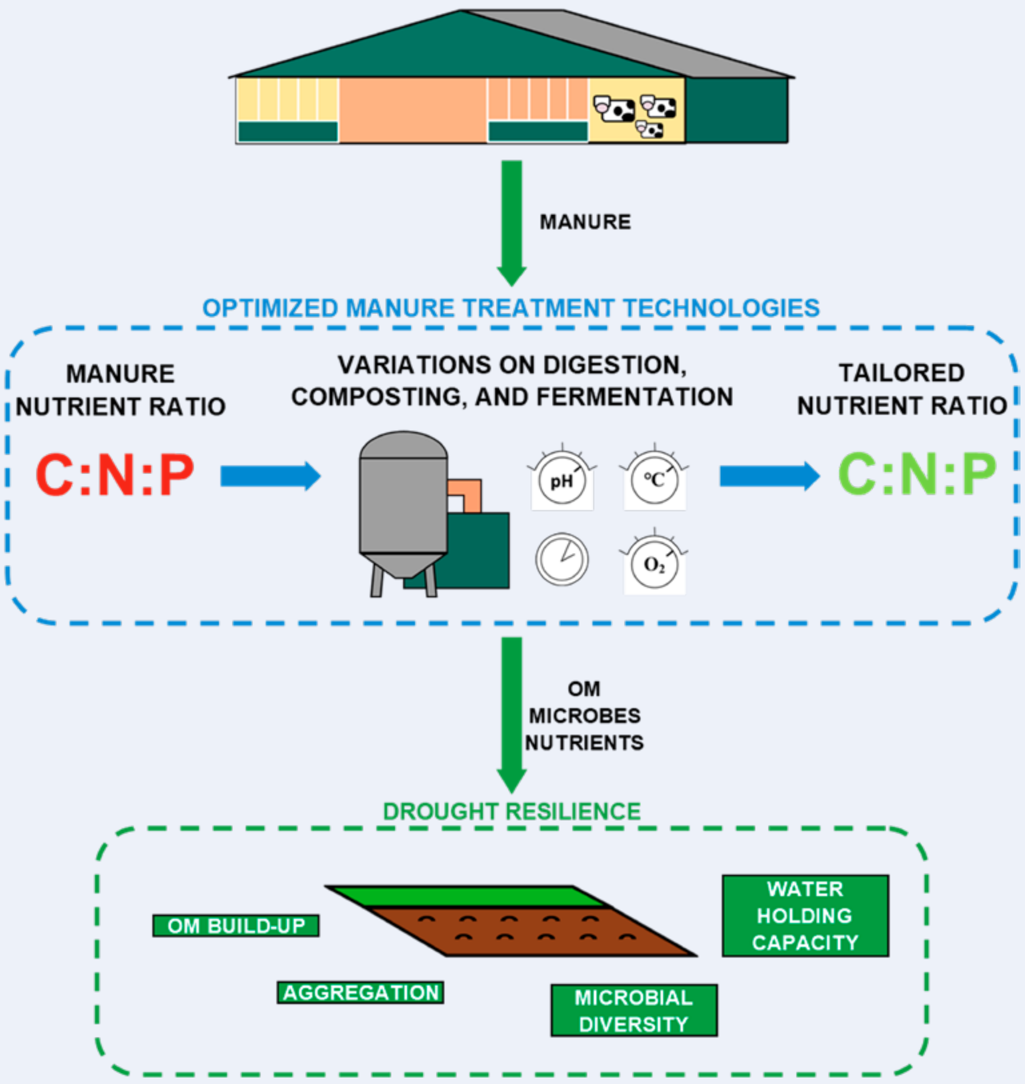


*Figure 1. Chain of events*

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