Plantain benefits beyond forage production

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Plantain (*Plantago lanceolata*) benefits beyond forage production

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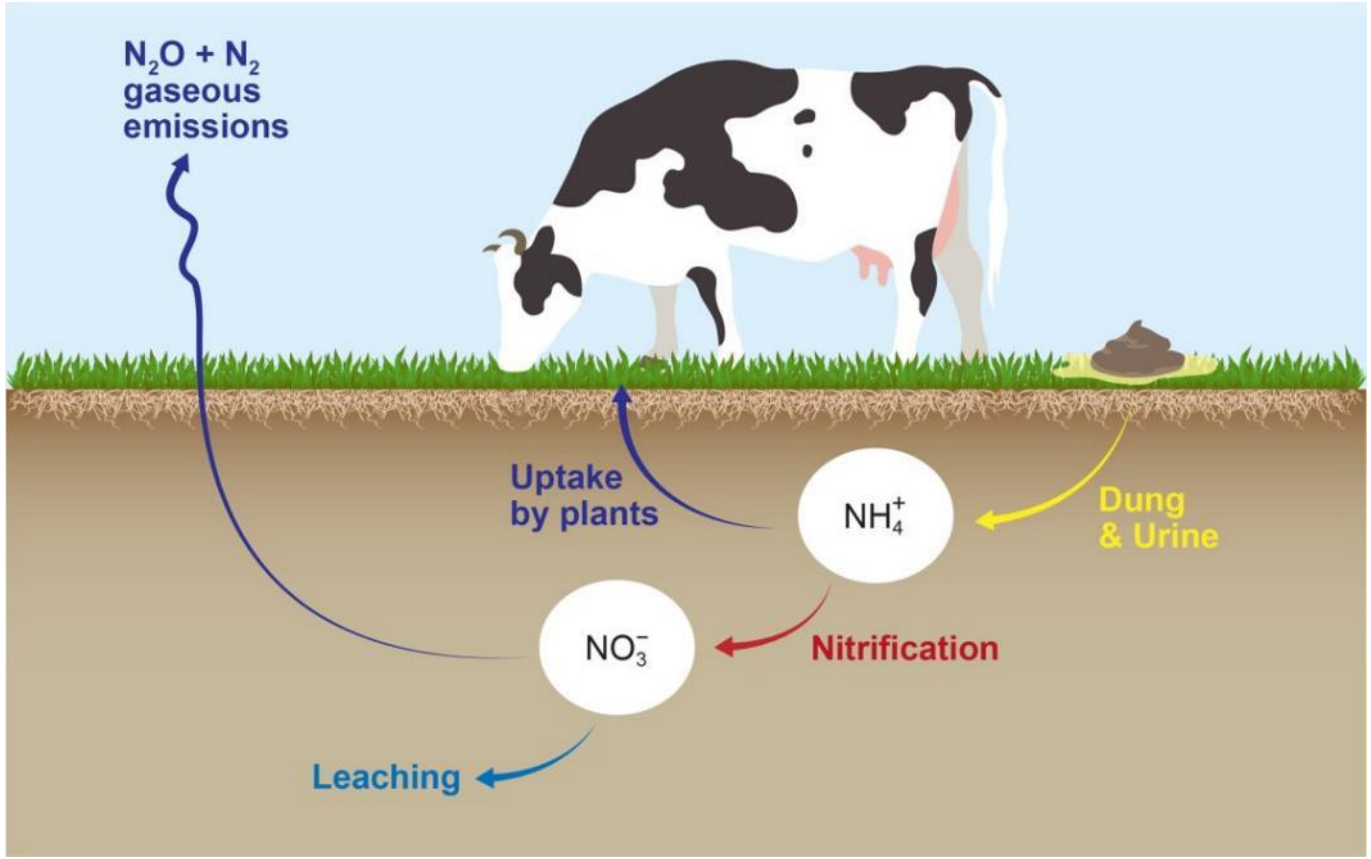
Pastoral farming in New Zealand

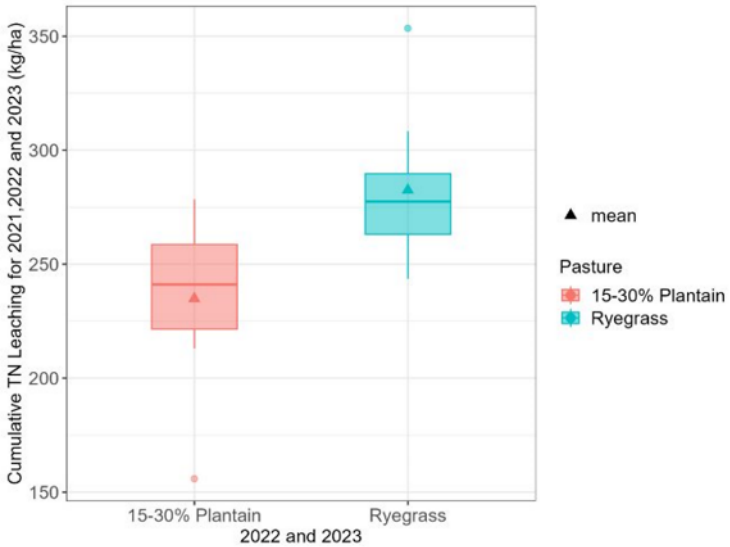
- Traditionally ryegrass/clover pastures.
- Limitations
  - Seasonal feed supply
  - Surplus N
- National and regional policies

N loss from pastoral systems

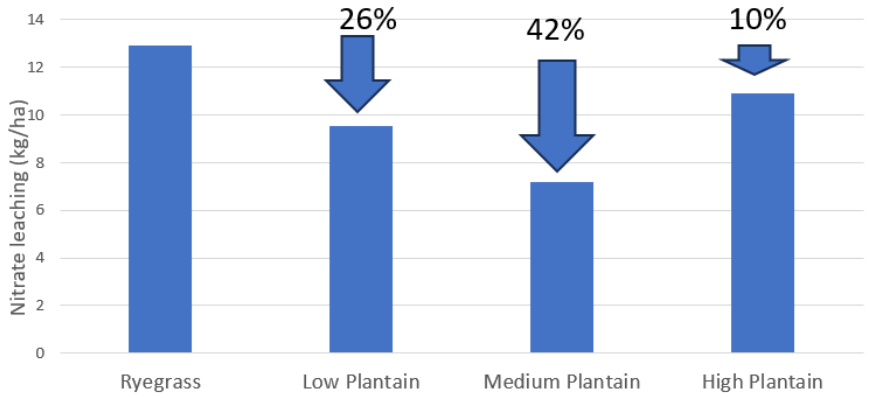


Reduced N leaching – paddock scale

Canterbury



Manawatu



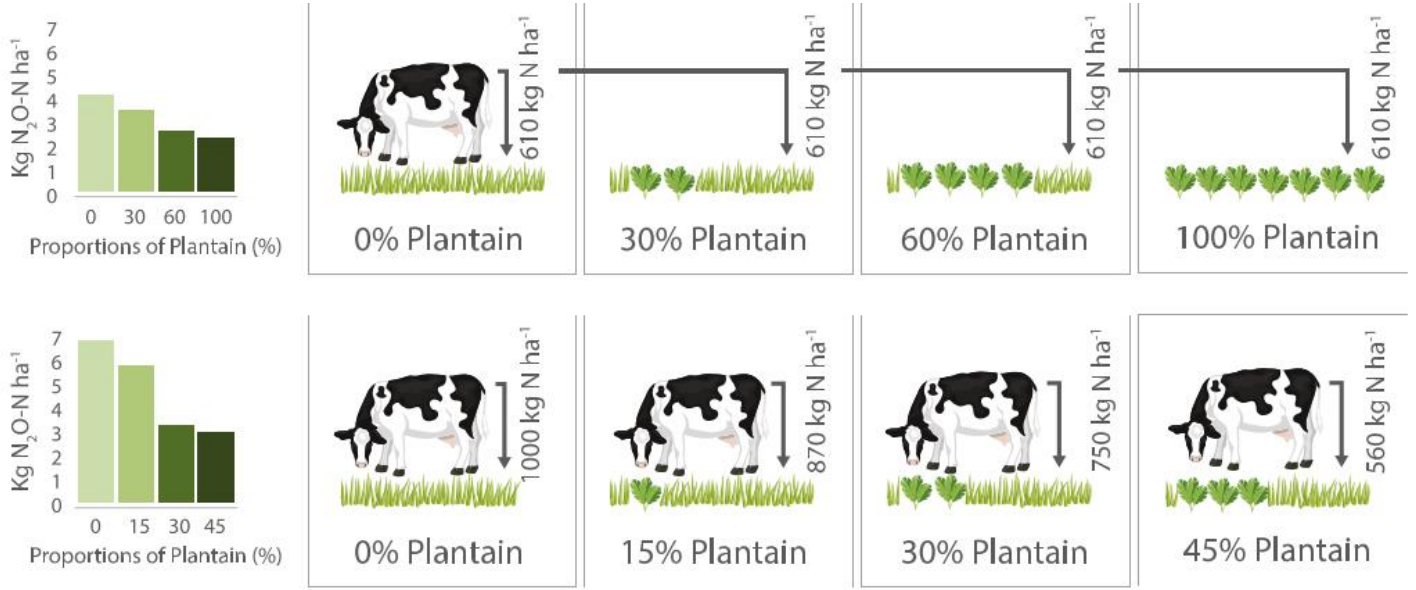
4-year average pasture composition and leaching reduction at Massey

	Ryegrass	Low Plantain	Medium Plantain	High Plantain
% plantain in sward	3	25	33	41
% plantain in diet*	2	17	23	29
% clover in the sward	15	14	13	20
% ryegrass in sward	73	52	46	29

*Plantain in the diet is lower than plantain in the sward due to around 30% of the diet being made up of supplement

Nitrous oxide emissions

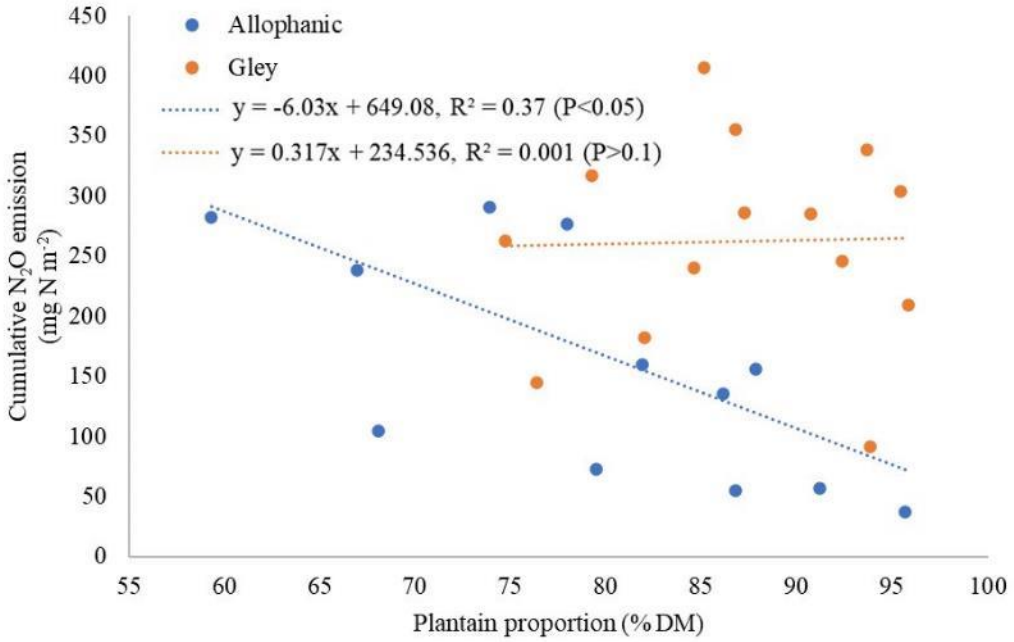
- N_2O decreases as plantain % in pasture increases.
- Further N_2O reductions when urine from cows fed plantain is deposited on to pastures containing plantain.



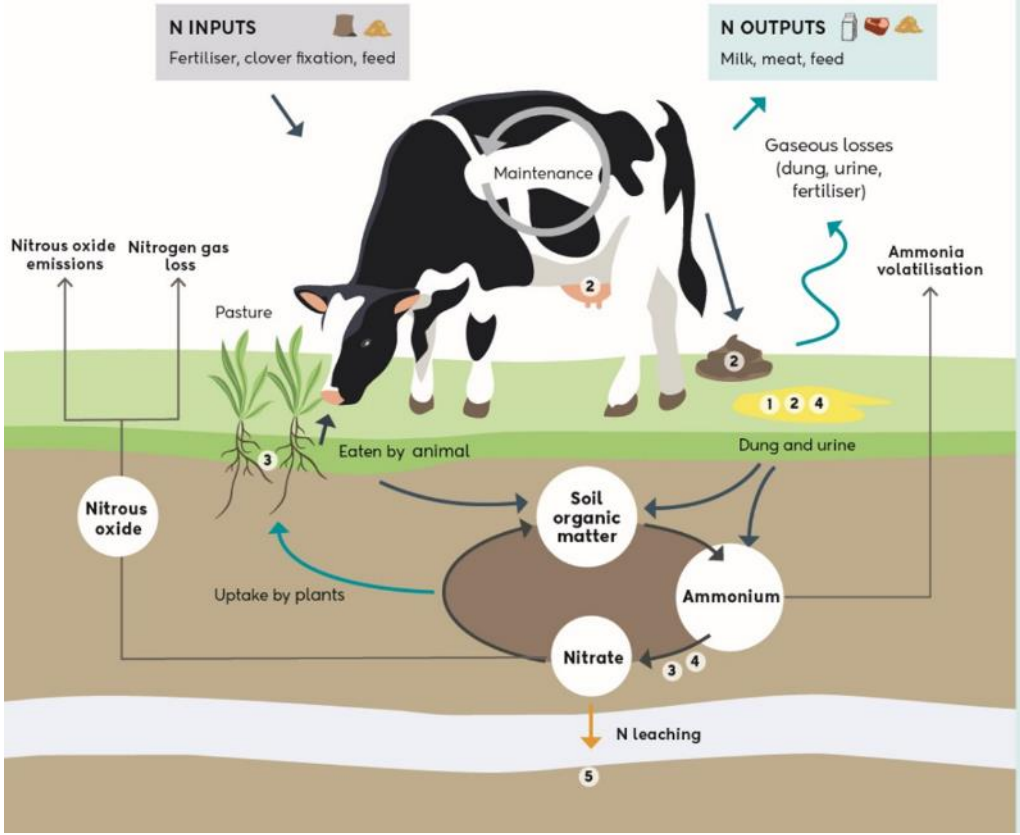
Simon et al. (2019)

Nitrous oxide emissions

- N_2O effect varies with climate and soil type.



Mechanisms for reduced N loss



1 **Dilution:**
Higher urination frequency and volume

2 **Partitioning:**
More N partitioned to dung and milk vs urine

3 **Nitrogen retention (root exudates):**
Secondary compounds from plantain roots and litter slowing nitrification.

4 **Nitrogen retention (urine):**
Derivatives of plant secondary compounds in urine slowing nitrification

5 **Reduced drainage:**
Reduced water draining below the root zone

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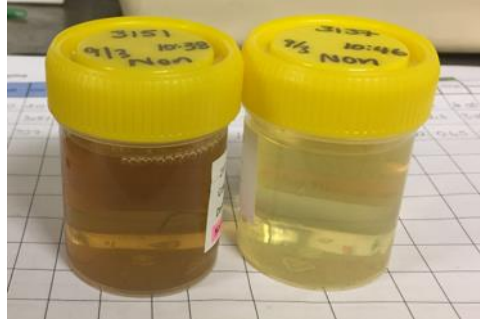
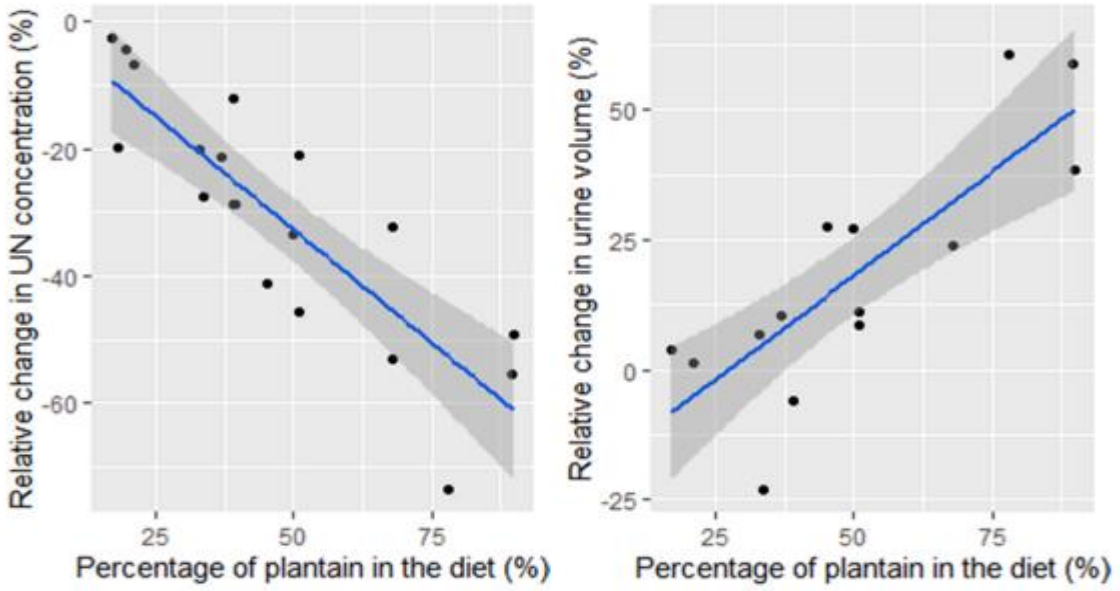
1. Dilution urine N

- Urine volume increases with increasing plantain in the diet.

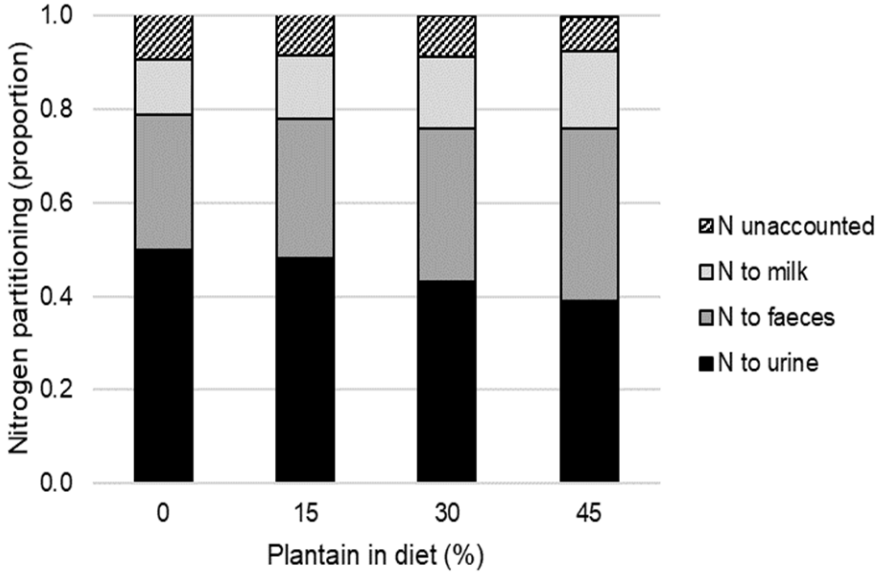


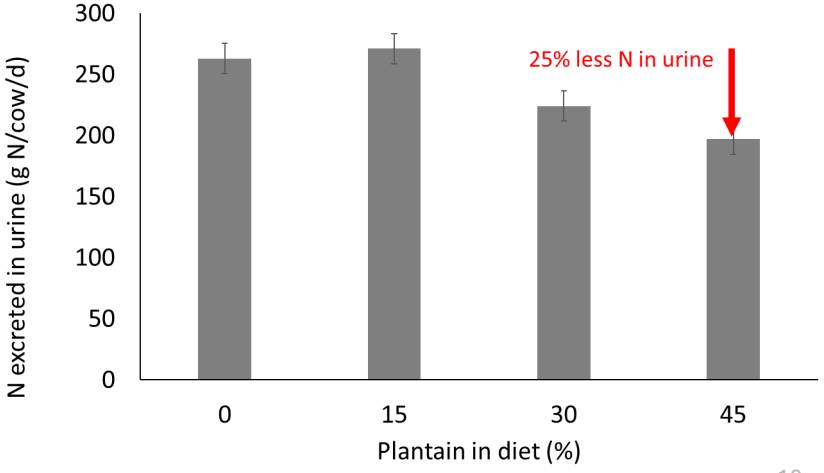


Nguyen et al. (2022)

2. Partitioning of dietary N

- More dietary N is partitioned to milk and faeces
- Less dietary N partitioned to urine



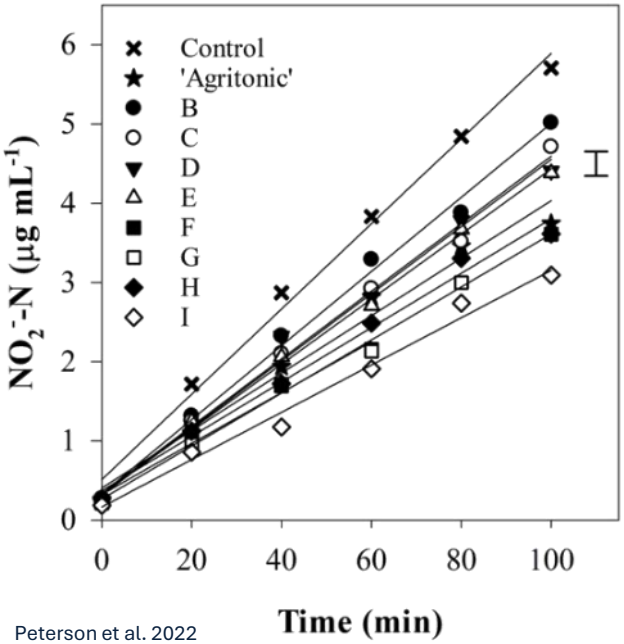


Minnee et al. (2020)

3 + 4. Reduced soil nitrification

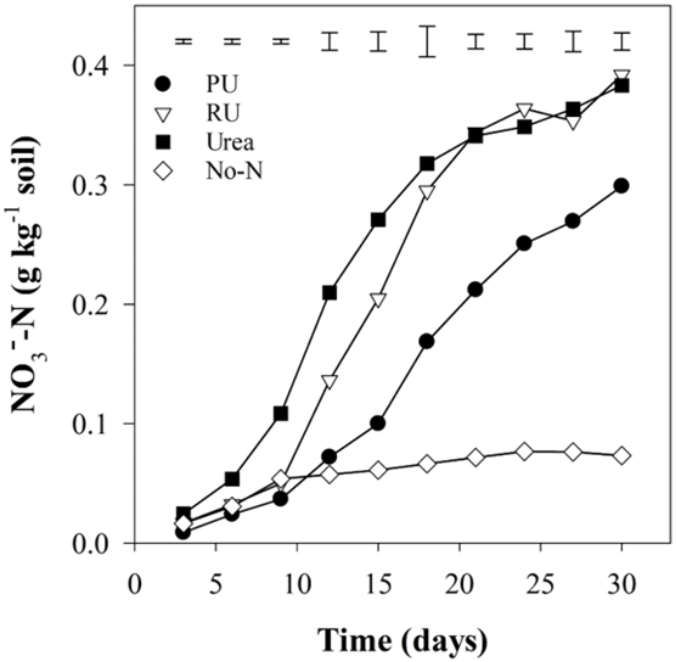
3. Plant effect

- Varies by cultivar



4. Urine effect

- Inhibition of nitrification from cattle fed plantain

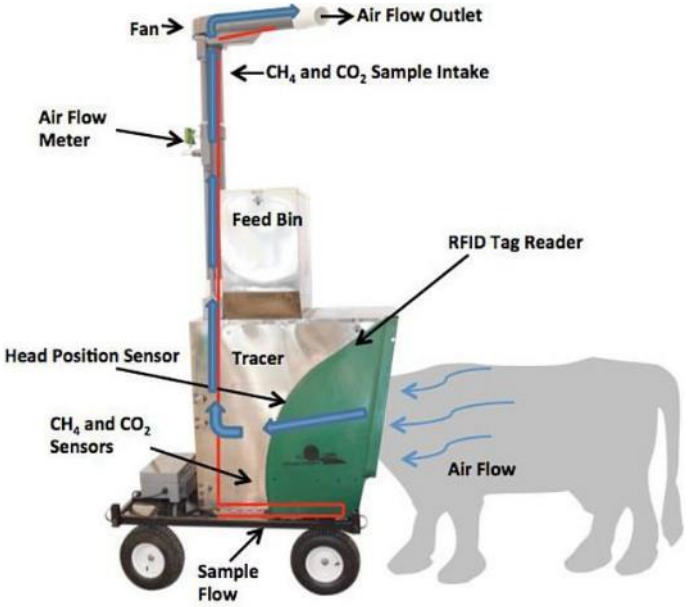


Peterson et al. 2022

Enteric methane emissions

Seasonal/lactation stage effect?

- Spring/early lactation: no difference
- Autumn/late lactation:
  - At 40% of the diet
    - 15% less CH_4 yield
    - 24% less CH_4 intensity
  - No difference between cultivars



Summary, benefits of plantain

- Potential to improve milk production and quality.
- Evidence for reduced N leaching and N_2O emissions.
- Maintain or improve CH_4 emissions.

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Thank you.

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