



# Biogas-Expert: Grassland methane yield and short-term N efficiency of biogas residues

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## Background and objectives

The biomass and methane yield potential of permanent grassland is well documented. However, there are only few studies on the efficiency of biogas residues with respect to crop yield and N uptake.

The objective of the present study is to analyse the short-term effect of biogas residues with respect to dry matter (DM) yield and methane hectare yield in comparison to mineral N fertilisation and cattle slurry.

## Material and Methods



- Field experiment (2007-2008) on a sandy aquod at Karkendamm, Northern Germany
- Perennial ryegrass dominated grassland (4-cut system)
- N fertilisation:  
N type: mineral N (calcium ammonium sulfate) or biogas residue (co-fermented maize and pig slurry)  
N-amount: 0, 160, 320, 480 kg N ha<sup>-1</sup> (split into 4 dressings)
- Quantification of specific methane yield [I<sub>N</sub> kg oDM<sup>-1</sup>): Hohenheim Biogas Yield Test (HBT) of pooled samples of 4 field replicates (unensiled, dried at 58 °C, ground to 1 mm, 3 lab reps, 28 days fermented at 38 °C)
- Quantification of fertiliser efficiency via Relative N Fertiliser Value (RNFV):  
$$RNFV = ANE_{manure} / ANE_{mineral\ fertilizer}$$
  
with Apparent N Efficiency (ANE)  
$$ANE = \frac{yield\ of\ treatment - yield\ of\ control}{N\ applied}$$
- Statistics: relation between N input and DM yield (t DM ha<sup>-1</sup>) as well as methane yield (m<sup>3</sup><sub>N</sub> ha<sup>-1</sup>) analysed by SAS Proc GLM assuming a quadratic function, with N input as covariable

## Results

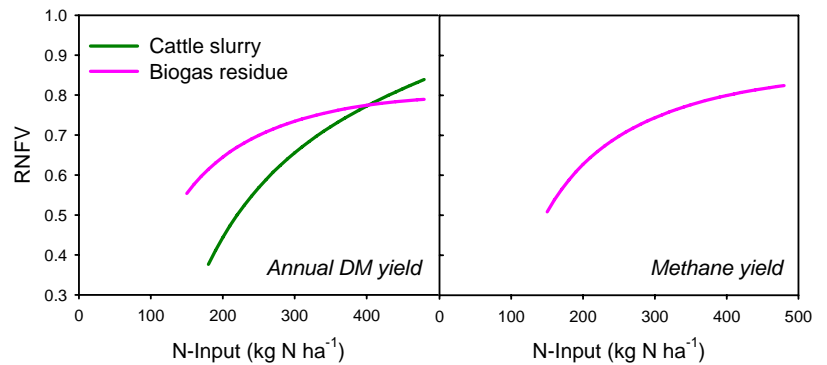


Abb. 1. Relative N Fertiliser Value (RNFV) for annual dry matter yield (t DM ha<sup>-1</sup>; left) and annual methane yield (m<sup>3</sup><sub>N</sub> ha<sup>-1</sup> a<sup>-1</sup>; right) as function of total N input (kg N ha<sup>-1</sup> a<sup>-1</sup>).

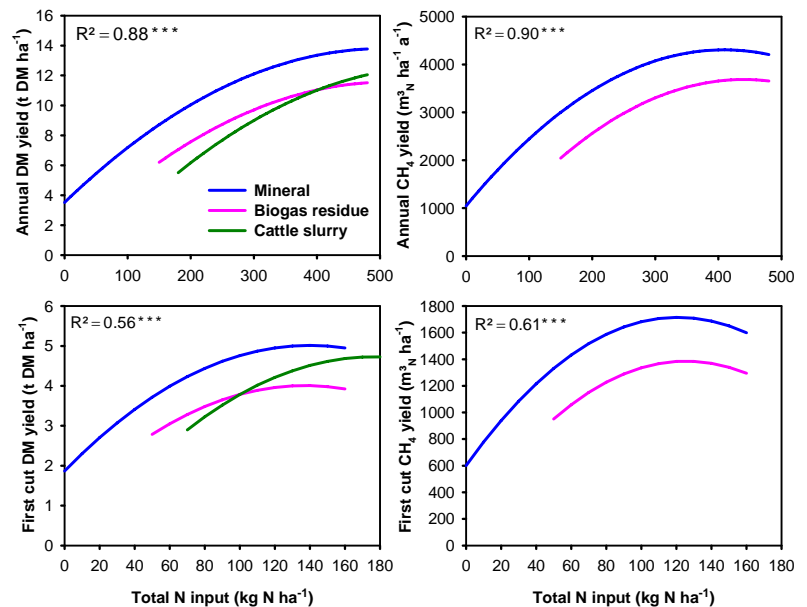


Abb. 2. Relation of total N input (kg N ha<sup>-1</sup>) to annual and first cut dry matter (t DM ha<sup>-1</sup>) and methane yield (m<sup>3</sup><sub>N</sub> ha<sup>-1</sup>) as influenced by fertiliser type.

## Conclusions

- Short term N-effect of biogas residue on DM and methane yield under low N input conditions higher than cattle slurry (Fig. 1); differences in yielding potential of biogas residue and cattle slurry (Fig. 2) mainly due to differences in NH<sub>4</sub>-N ratio
- Further studies required to investigate long-term effects on C/N flows, since biogas residues lack easily degradable C compounds

