Nitrogen fertilizer value of digestates from anaerobic digestion of animal manures and crops

Peter Sørensen

Department of Agroecology, Aarhus University, Foulum, Denmark

Peter Mejnertsen

Knowledgecentre for Agriculture, Aarhus, Denmark

Henrik B. Møller

Department of Biosystems Engineering, Aarhus University, Aarhus, Denmark

AARHUS UNIVERSITY
DEPARTMENT OF AGROECOLOGY

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E-mail: peter.sorensen@agrsci.dk

Introduction

- The Danish government has the ambition that 50% of animal manure in DK is digested for biogas production by 2020.
- In DK organic farming there is increasing focus on biogas production based on green manures to produce renewable energy and to optimize nutrient utilization.

Objectives

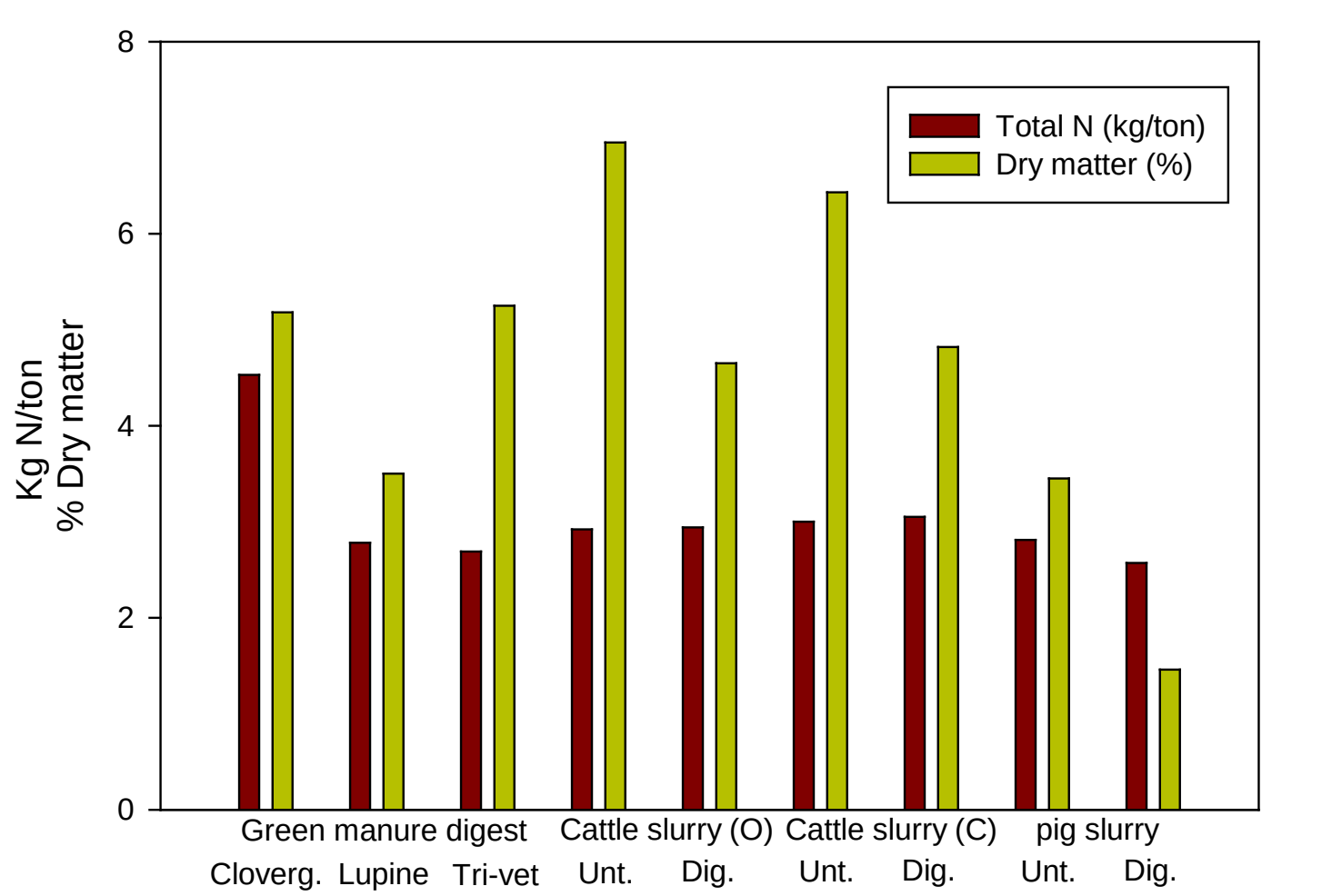
- To quantify effects of anaerobic digestion of ”pure” pig and cattle slurries on N fertilizer values and N turnover in soil.
- To quantify the fertilizer value of digested green manures.
- To compare the fertilizer value of digestates after injection before sowing and surface-banding in a crop.

Manures and digestates used in experiments

- Green manures/plant-based digestates
  - Clovergrass
  - Yellow lupine
  - Triticale + winter vetch
- Cattle slurry (conventional and organic farm)
- Pig slurry

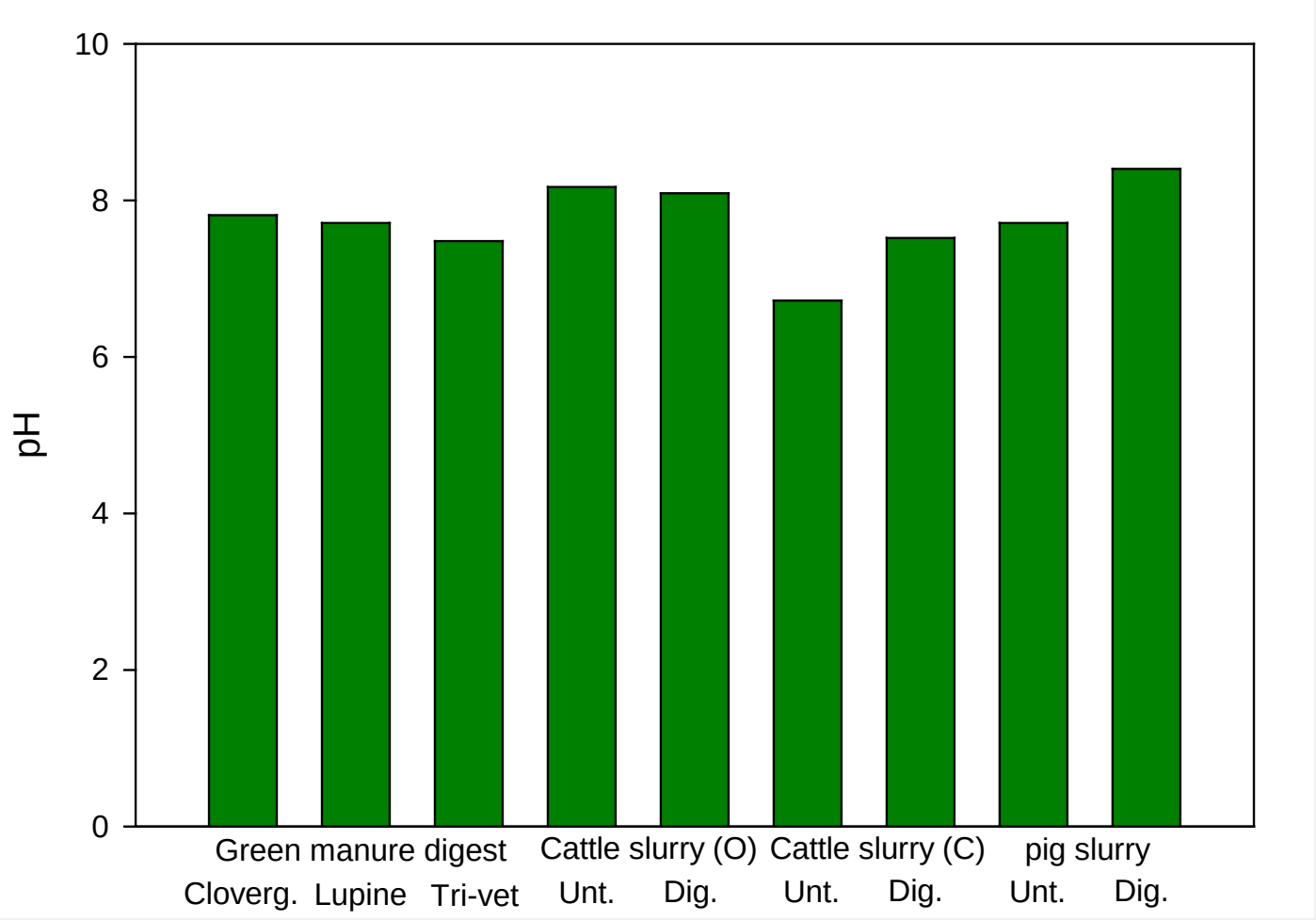
Manures digested in flow-system thermophillic (47-52°C) pilot digesters (130L).
About 20 days avg. retention time.

Total N and dry matter in manures

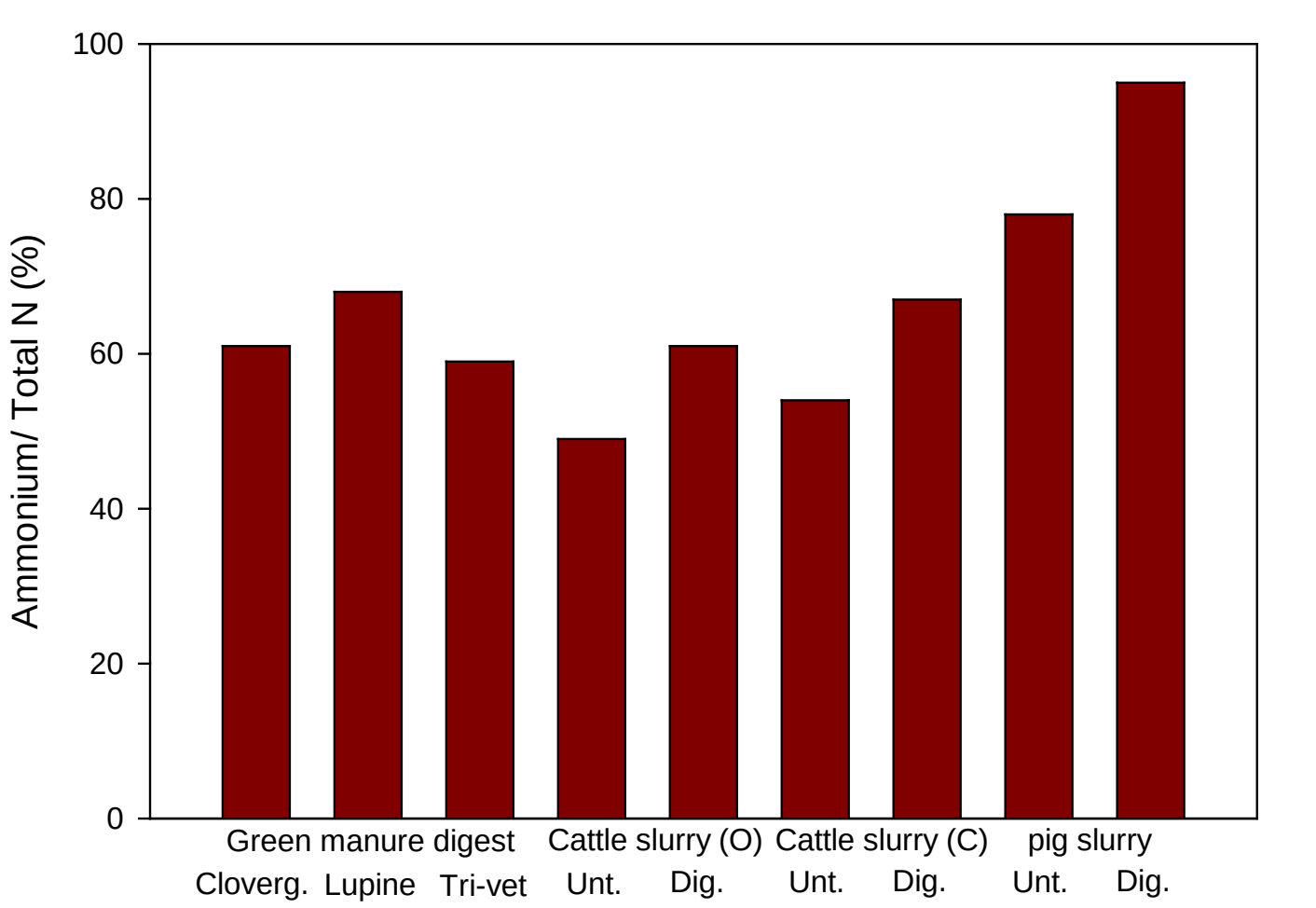


Unt. = untreated

High pH in digestates

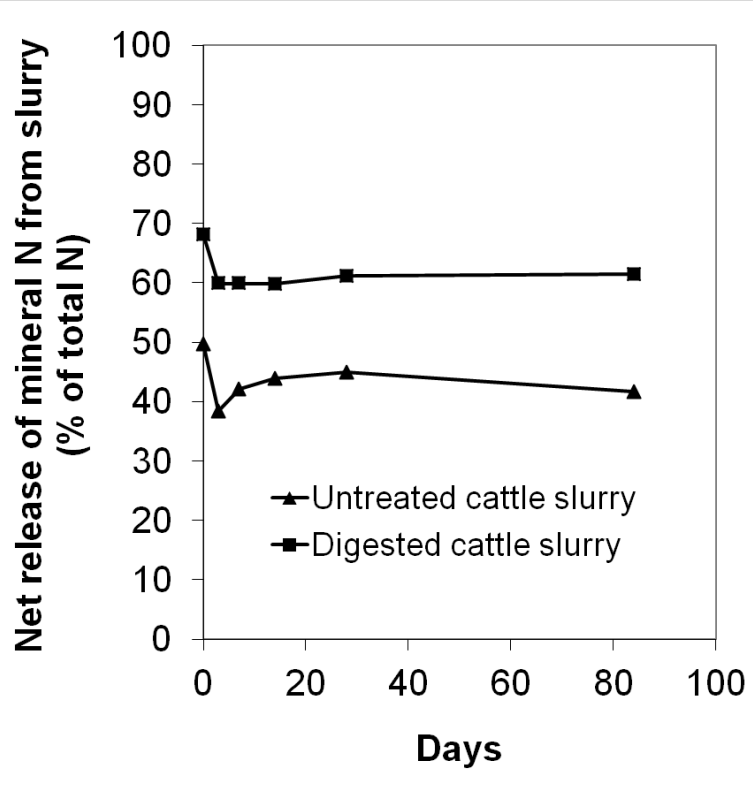


More ammonium-N after digestion

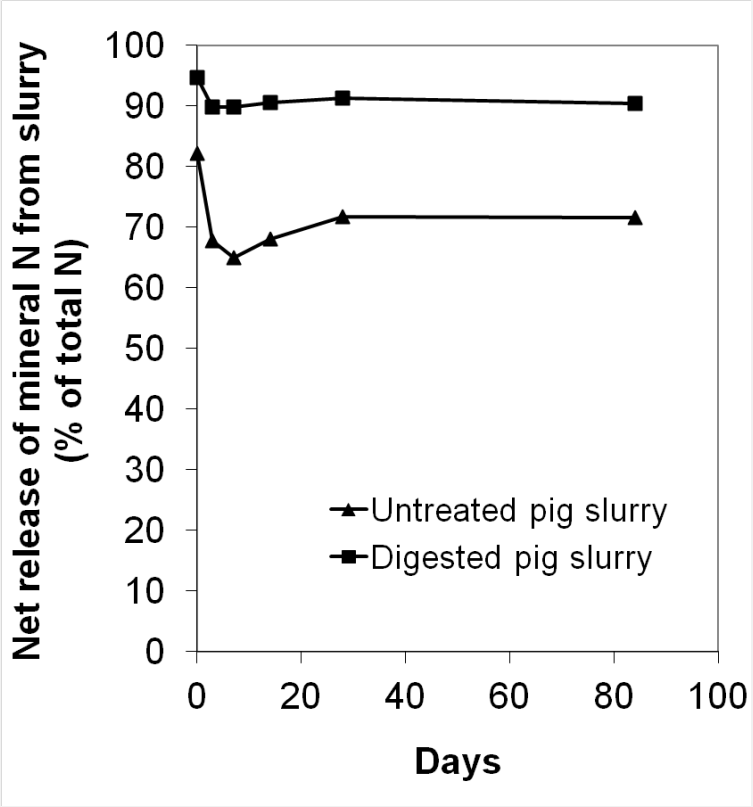


Net N release of mineral N after incubation in soil

Cattle slurry (organic)



Pig slurry



Loamy sand, 10°C

Extra mineral N release equivalent to 15-20% of total N after digestion.

(From Sørensen and Møller, 2009)

Nitrogen fertilizer replacement value (NFRV) measured in field experiments

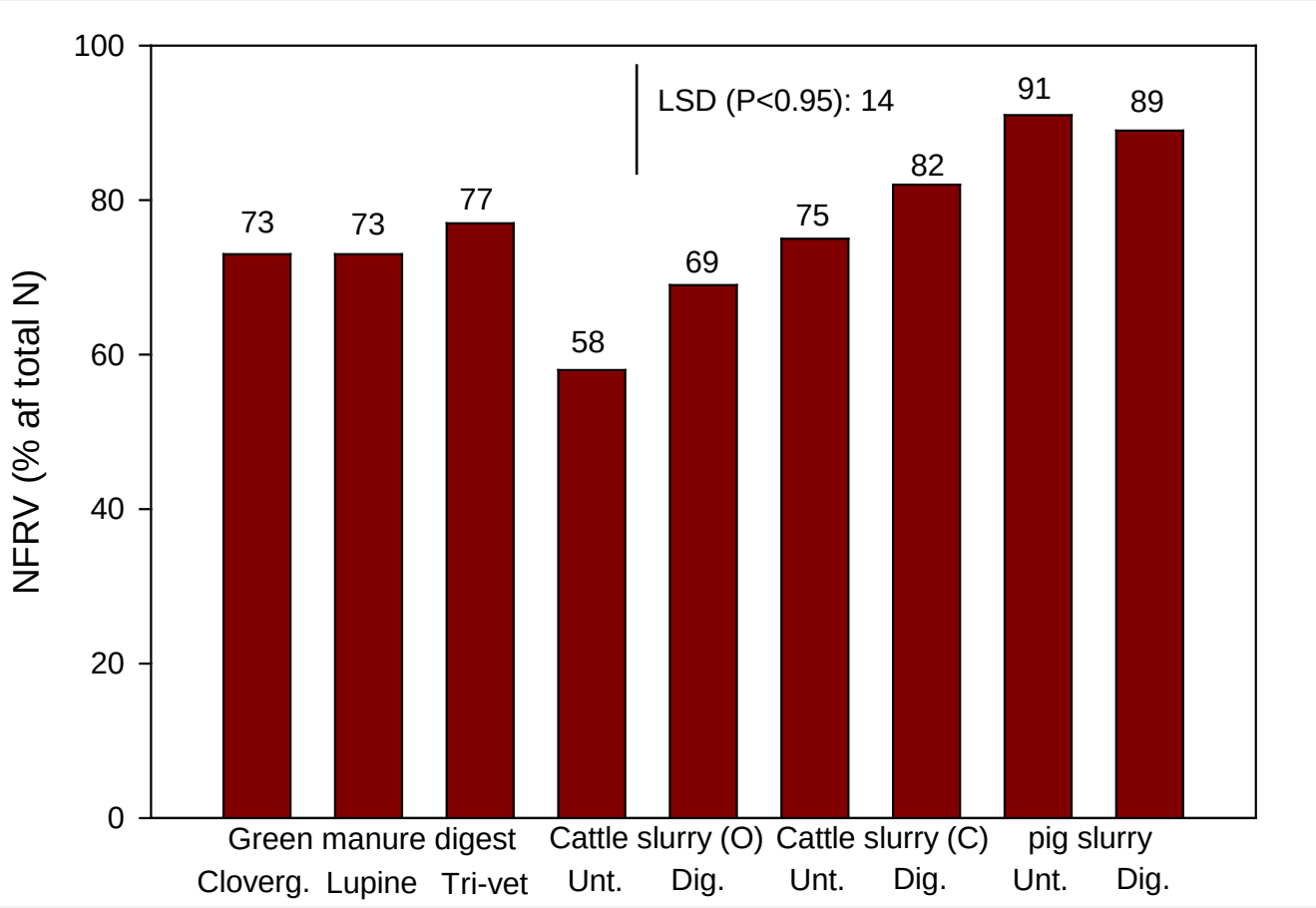
- N uptake in grain on manure plots related to plots with increasing mineral N fertilizer application (response curve).
- Direct injection to spring barley and oats (80 kg total N/ha).
- Surface-banding in winter wheat (150 kg total N/ha).

Spring barley plot

Winter wheat plot

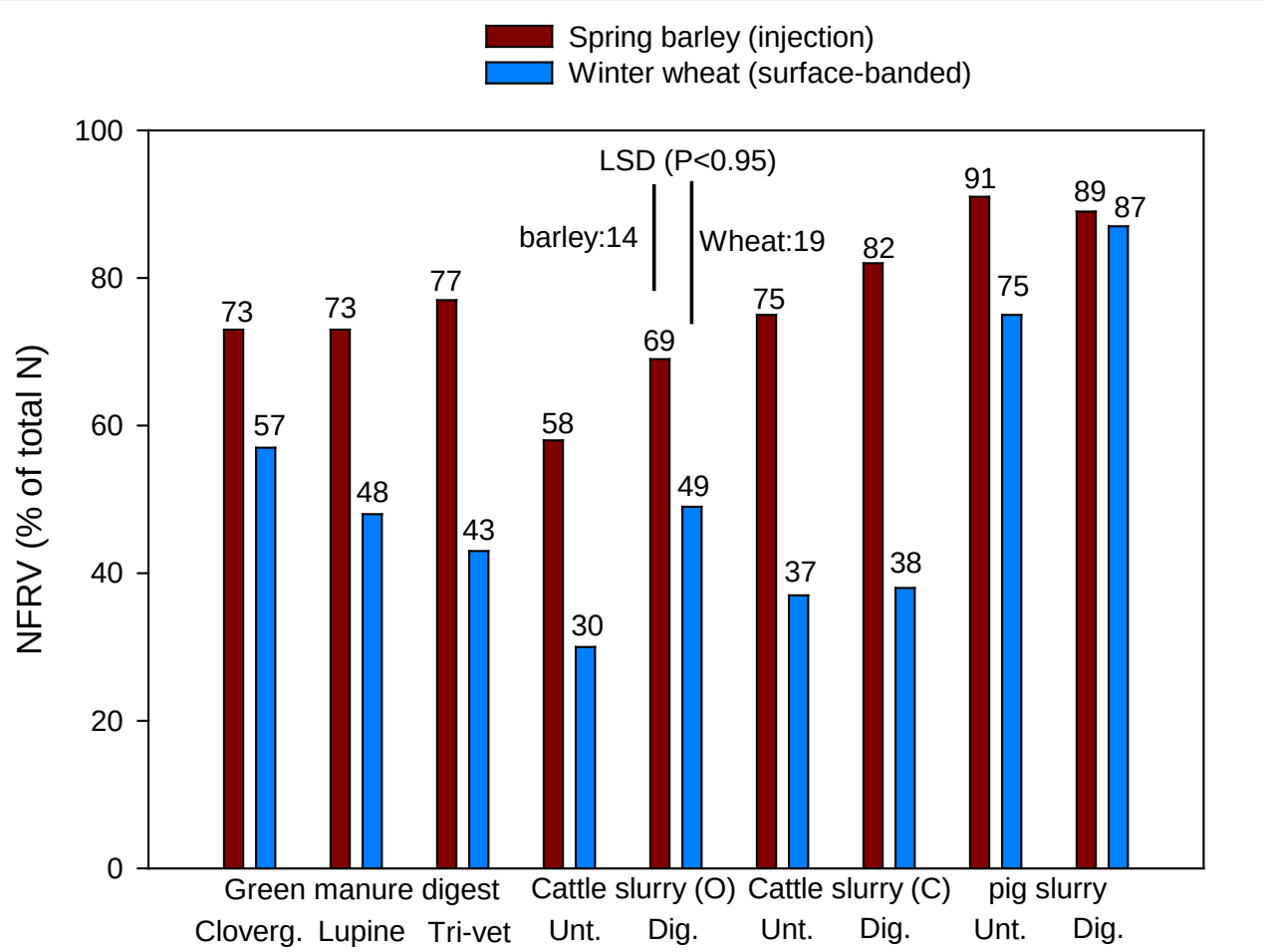
Barley

Fertilizer effect after injection to spring barley



Similar effects in oats (not shown)

Lower fertilizer effect after surface-banding in winter-wheat



Conclusions

- About 75% of N in digested green manures was plant available after direct injection of the digestates (availability similar to digested cattle slurry).
- The potential plant availability of pig and cattle slurry N can be expected to increase by 10-15% points by digestion.
- Digestates should be injected or incorporated immediately after application to avoid significant ammonia losses.

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Thank you!