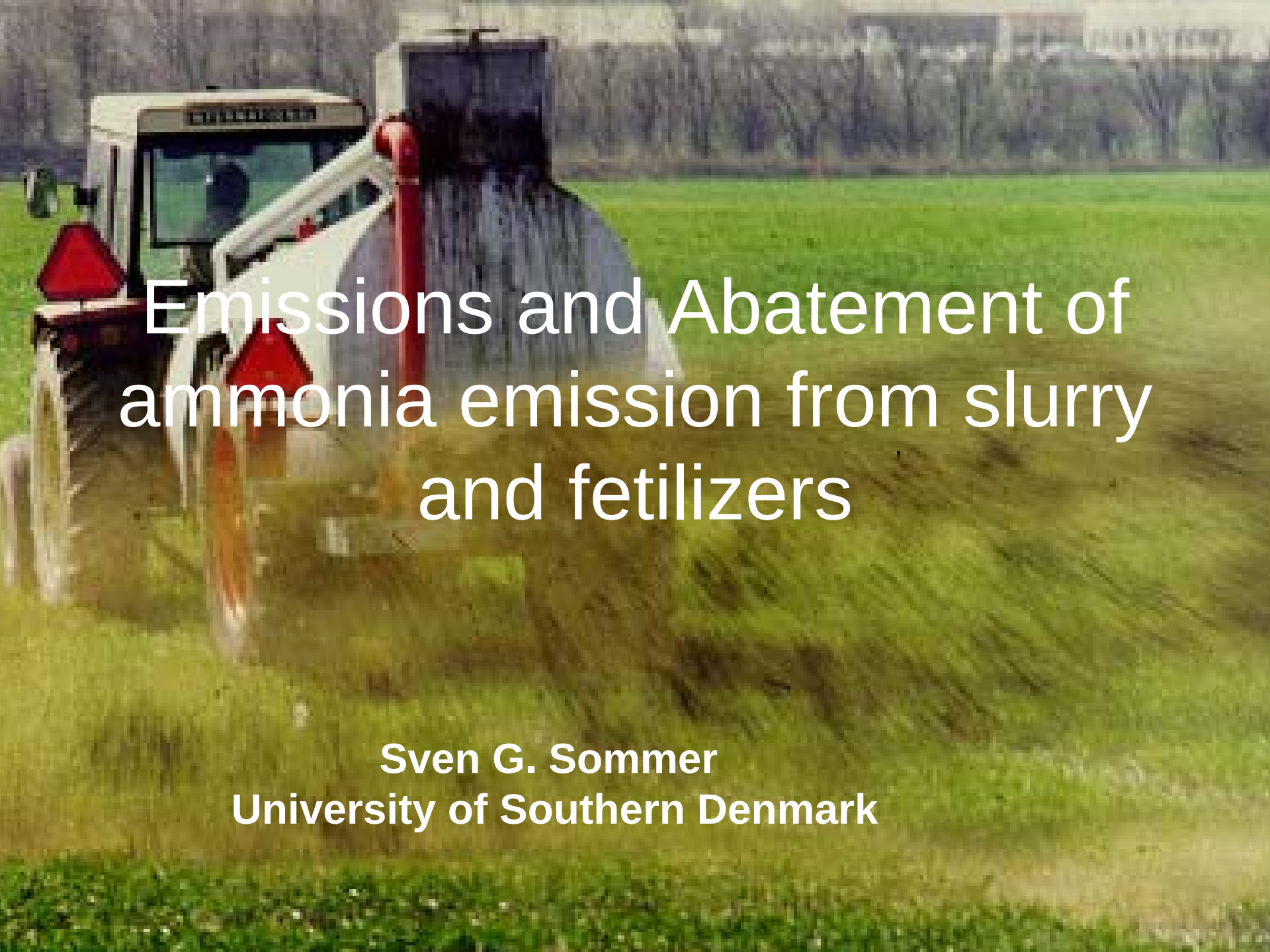


Emissions and Abatement of ammonia emission from slurry and fetilizers

Sven G. Sommer
University of Southern Denmark

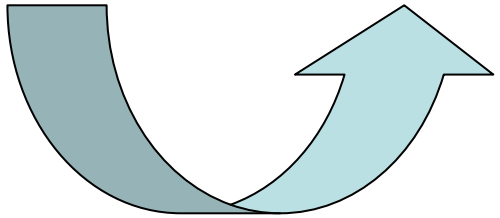
Why being concerned about ammonia volatilisation

- Reduce plant nutrient value of livestock manure
- Causes environmental problems (eutrofication)

Ammonia loss processes

Atmosphere

$NH_{3,a}$



Atmospheric boundary layer, mm-cm

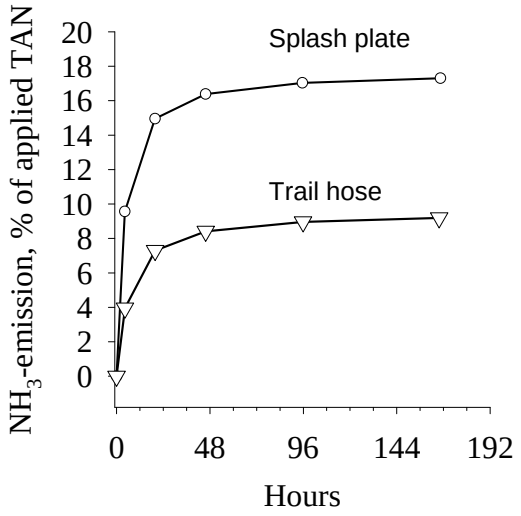
$NH_{3,g}$

Slurry surface layer, cm

$$NH_4^+ \leftrightarrow NH_3 + H^+$$

$$NH_3 = \frac{TAN}{1 + (H_3O)^+ / K_N(Temp)}$$

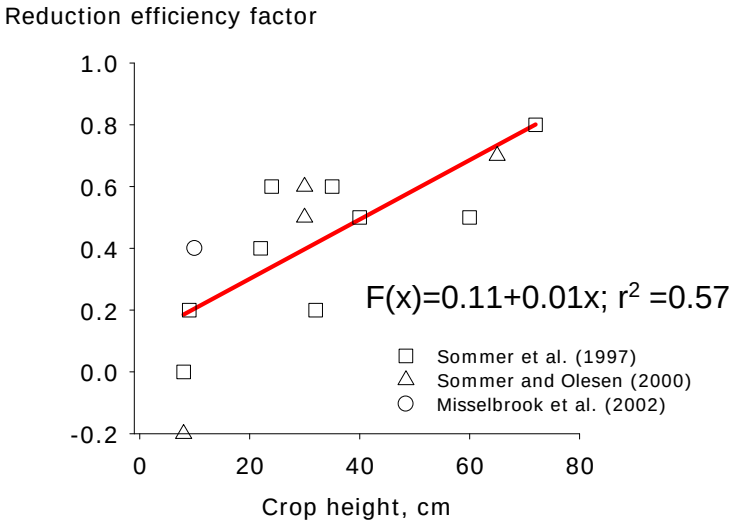
Trail hose application/band application

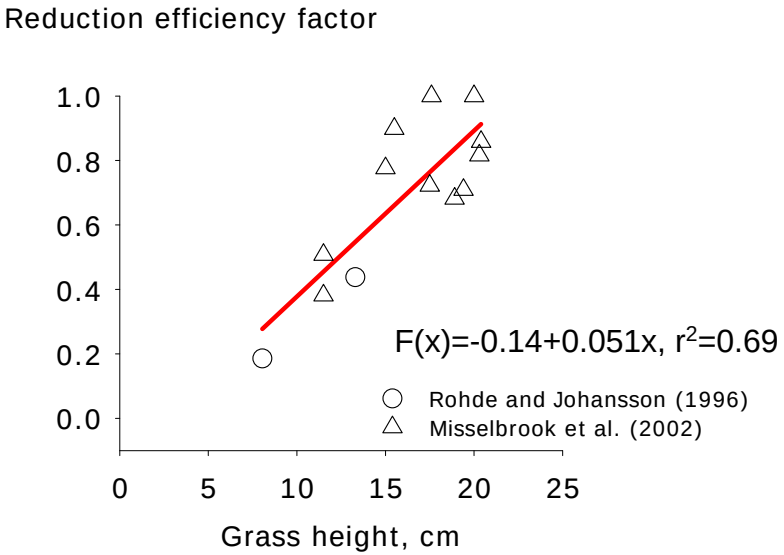


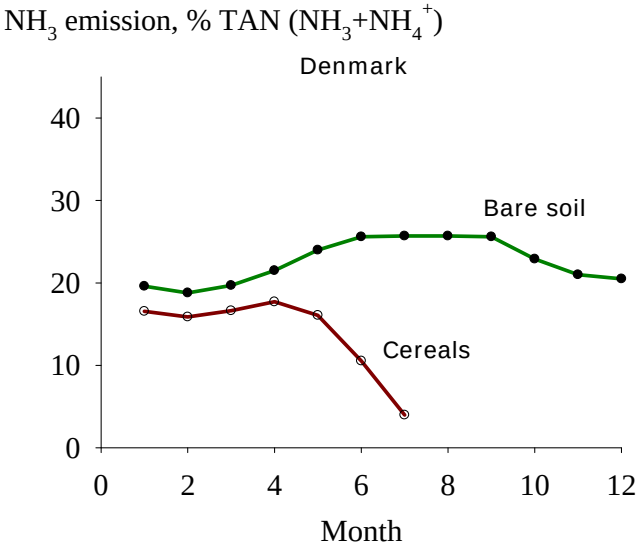
- On the soil below crop canopy
- Plants: Provide shadow, i.e. reduced wind speed and temperature, NH3 is taken up by crops (up to 25% of emitted NH3)
- Soil: Improved infiltration in the soil, reduced area of slurry band

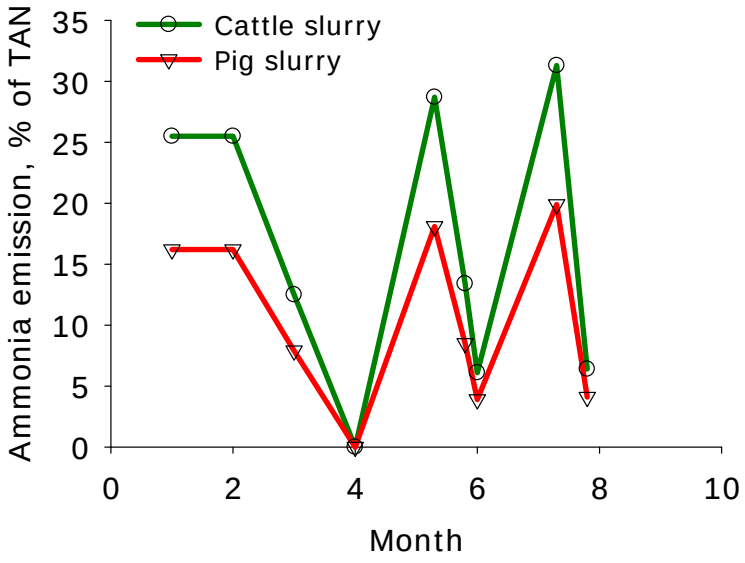
Trailhose efficiency

Thorman R.E., Hansen, M.N., Misselbrook T.H. , Sommer S.G. 2008. Algorithm for estimating the crop height effect on ammonia emission from slurry applied to cereal fields and grassland. Agronomy for Sustainable Development. 28, 373–378



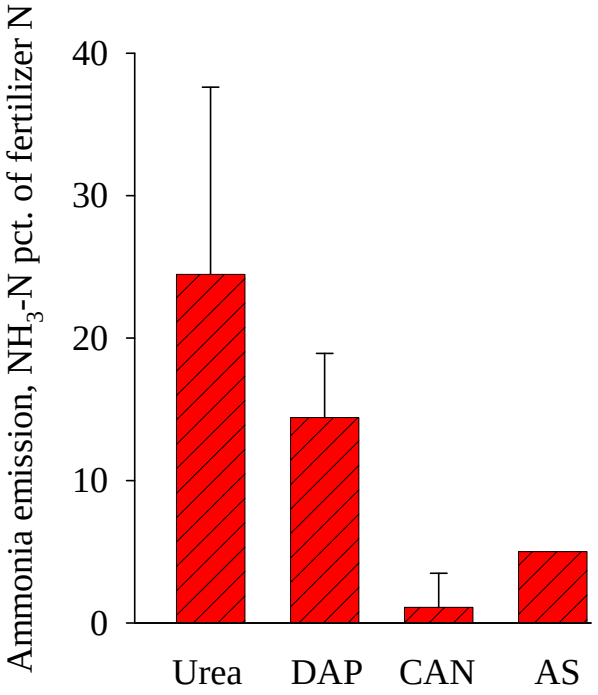






Sommer, S.G. , Schjørring, J.K. and Denmead, O.T. 2004. Ammonia volatilization from mineral fertilizers and plants in fields ammended with ammoniacal fertilizers. Advances in Agronomy 82, 557-662.

Ammonia emission from mineral fertilizers, wind tunnel studies



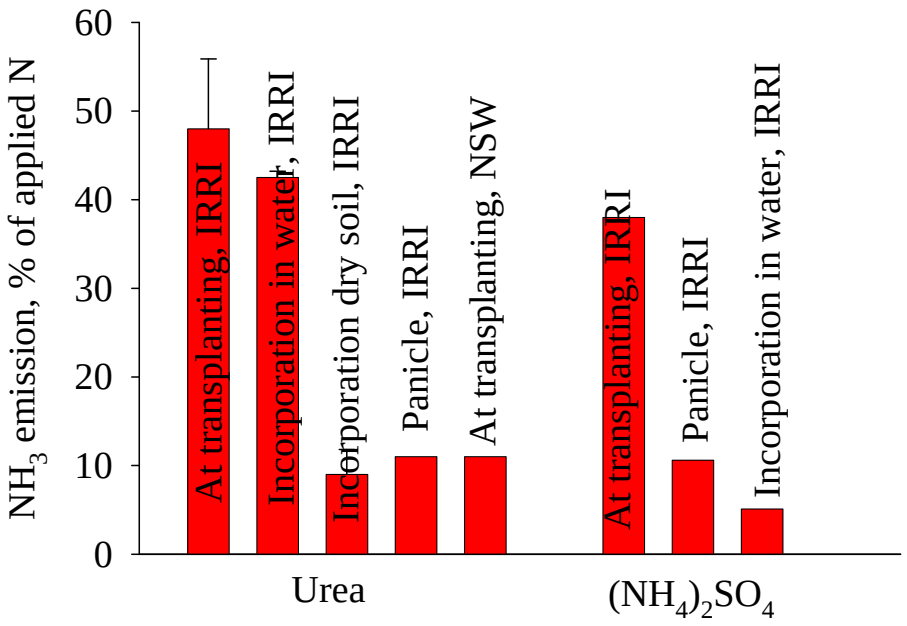
Sommer et al. 2004

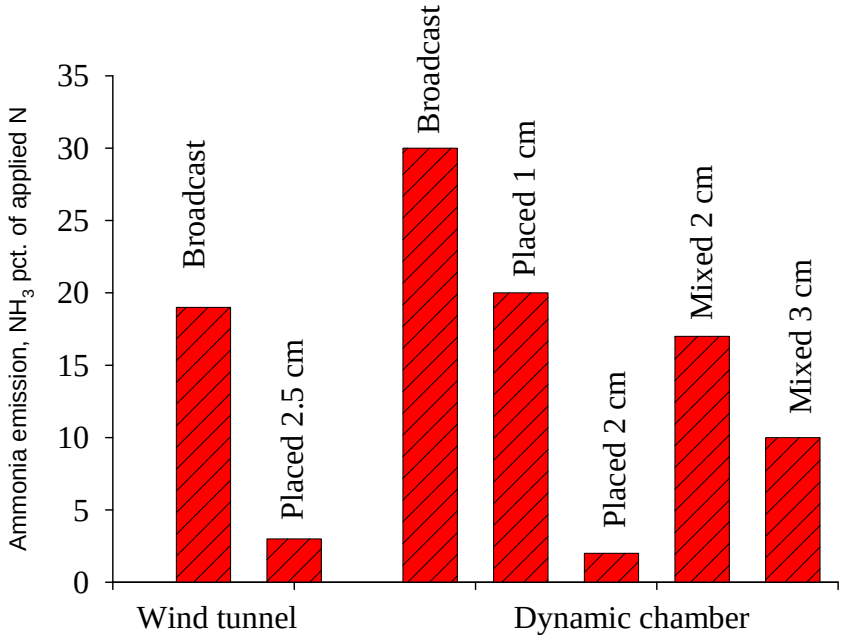
$$NH_4HSO_4 + H_2O \leftrightarrow NH_3 \uparrow + H^+ + HSO_4^-$$

$$CO(NH_3)_2 + 2H_2O \leftrightarrow NH_3 + NH_4^+ + HCO_3^-$$

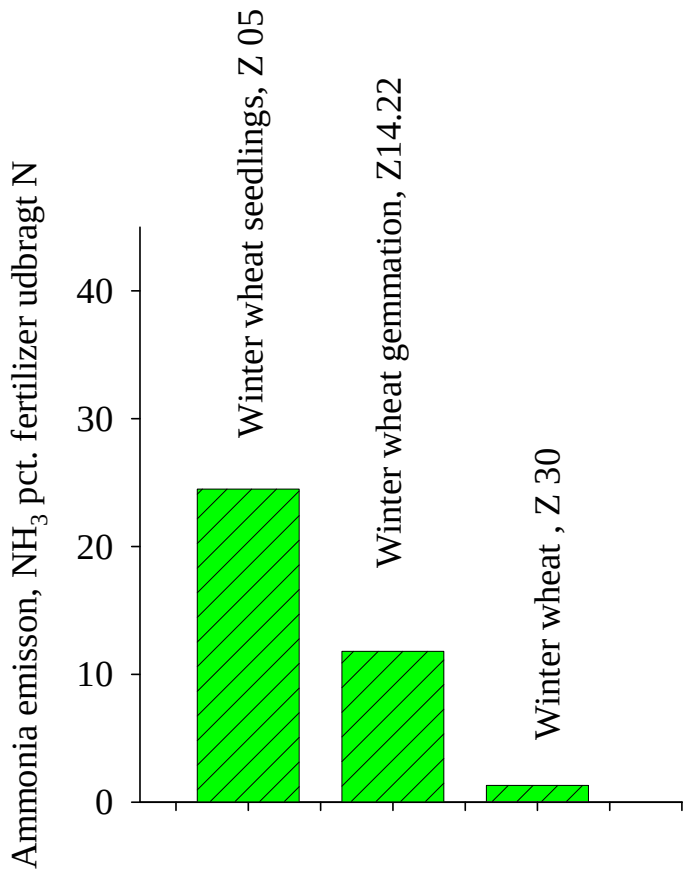
$$(NH_4^+) + HCO_3^- \leftrightarrow NH_3 \uparrow + CO_2 \uparrow + H_2O$$

Effect of placing rertilizers
Paddy rice and bare soil

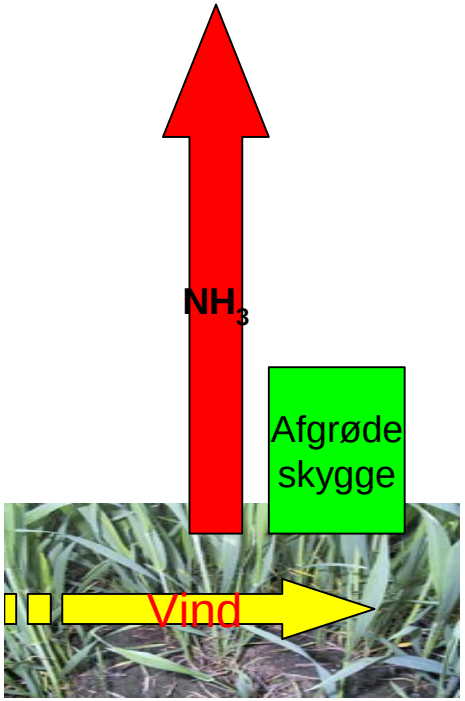




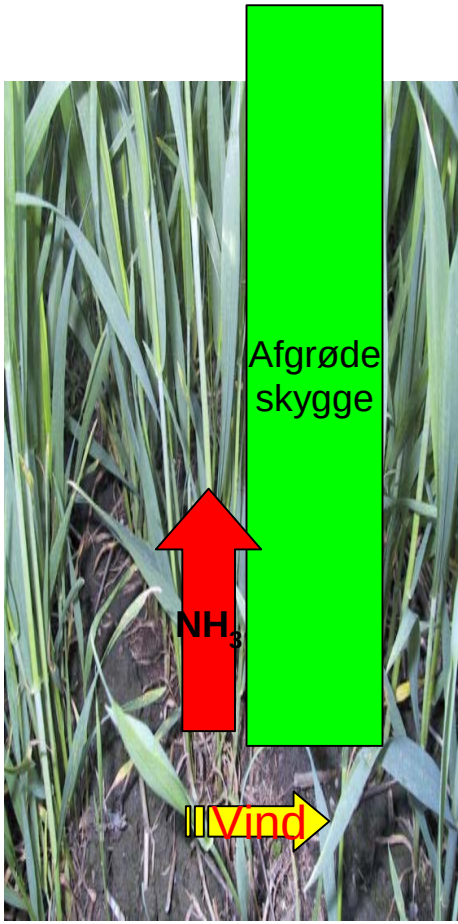
Ammonia emisison fromurea applied to winter wheat, mikro. met studier



Bacon and Freney, 1989

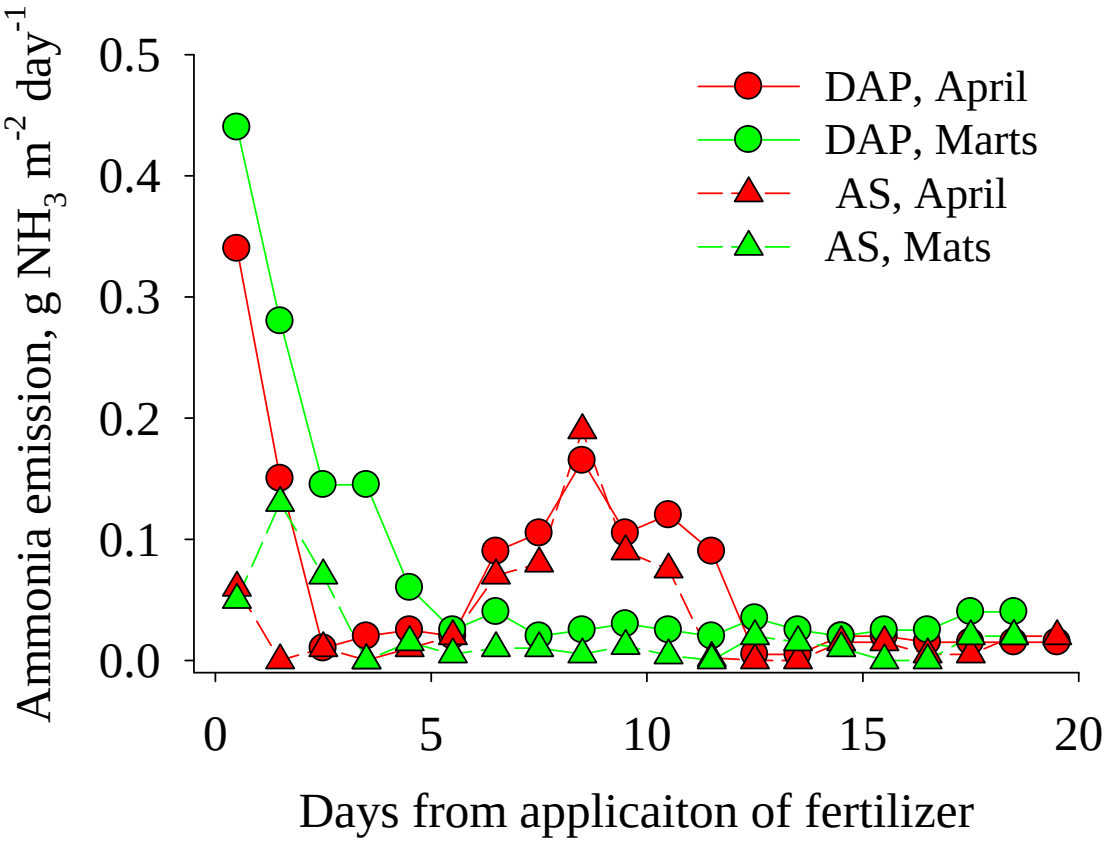


April

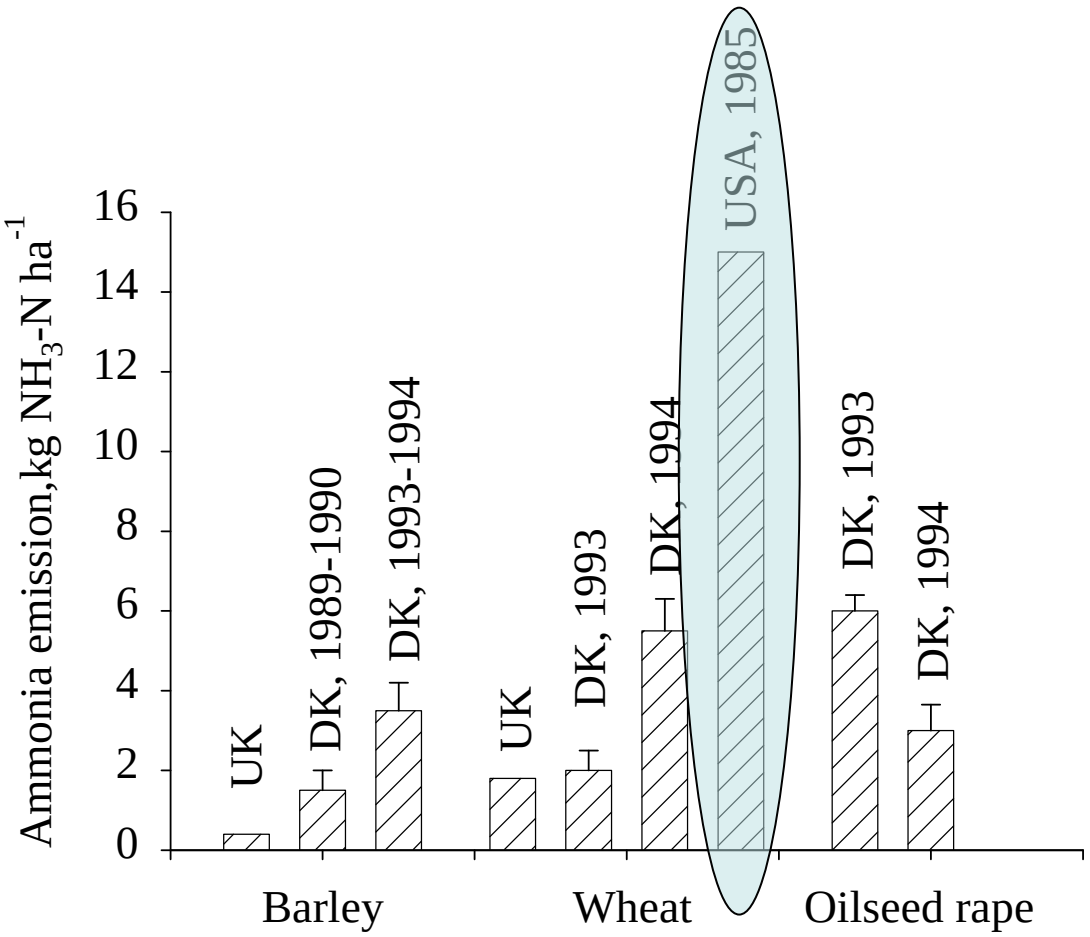


Juni

Mineral fertilizer application to grass (Ital. ryegrass), NH_3 emission from plant



Ammonia emission from crops



Kompensations punkt

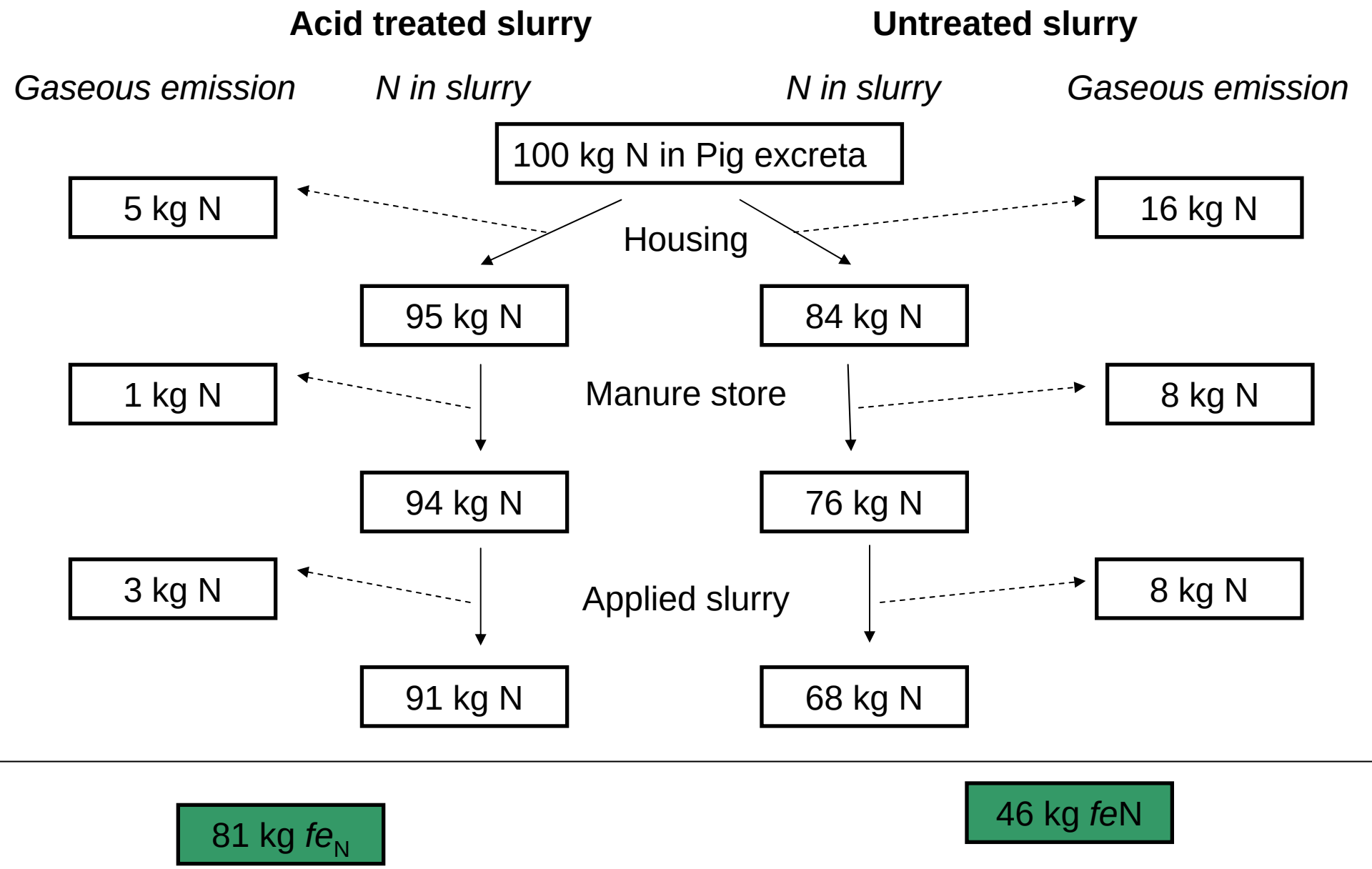
- Ingen transport gennem cellevæg

$$F_{NH_3} = g_{leaf}(\chi - NH_{3,a})$$

- Al transport gennem stomata (læbeceller)
- Lineært op til 500 nmol mol^{-1}
- Kompensationspunkt fra
  - Mellem gødskning 0,02 microg NH_3 m^{-3}
  - Efter gødskning 10 microg NH_3 m^{-3}
  - Variation på 1-7 nmol mol^{-1}

Whole system effect of acidification of slurry in-house

Acidification of slurry in house



Conclusion

- Trail hose application: Efficiency related to crop height