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Does acidification of livestock slurry at land spreading increase greenhouse gas emissions

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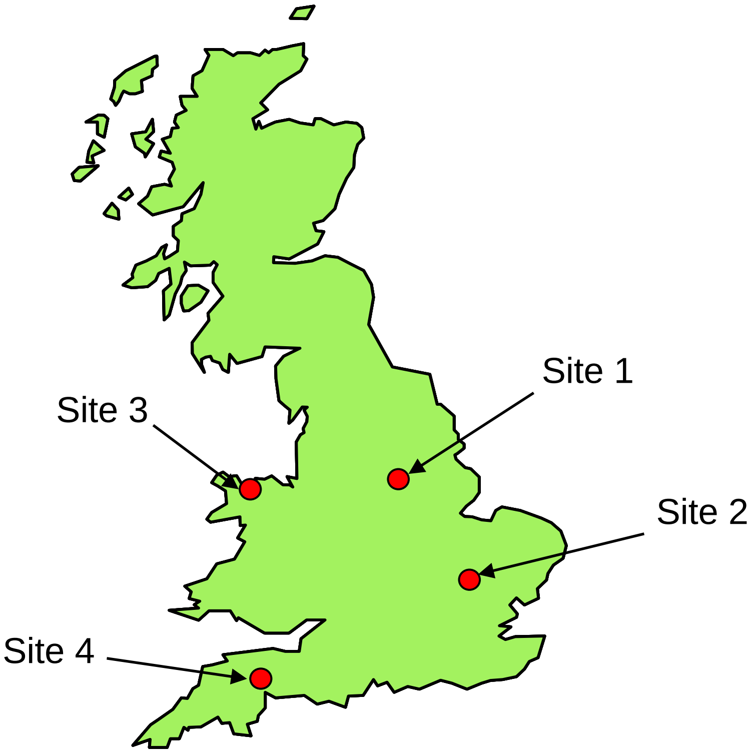
Introduction

- In the UK agriculture is responsible for c.85% of ammonia (NH_3) emissions
- UK targets to reduce NH_3 by 16% of 2005 levels by 2030
- Acidification has been identified as a measure to abate NH_3 emissions
- Conserved N can increase the N fertiliser replacement value of slurry, & potentially lead to “pollution swapping”
- Important measures implemented to reduce NH_3 emissions do not result in increased losses of GHGs

Experimental sites

- Arable
  - Site 1 – ADAS Gleadthorpe; sandy loam soil
  - Site 2 – ADAS Boxworth; clay soil
- Grassland
  - Site 3 – Bangor University; sandy clay loam soil
  - Site 4 – Rothamsted Research; clay soil
- Pig slurry applied to arable land:
  - Autumn 2019 & Spring 2020
- Cattle slurry applied to grassland:
  - Spring 2020 & Summer 2021
- Treatments replicated x5



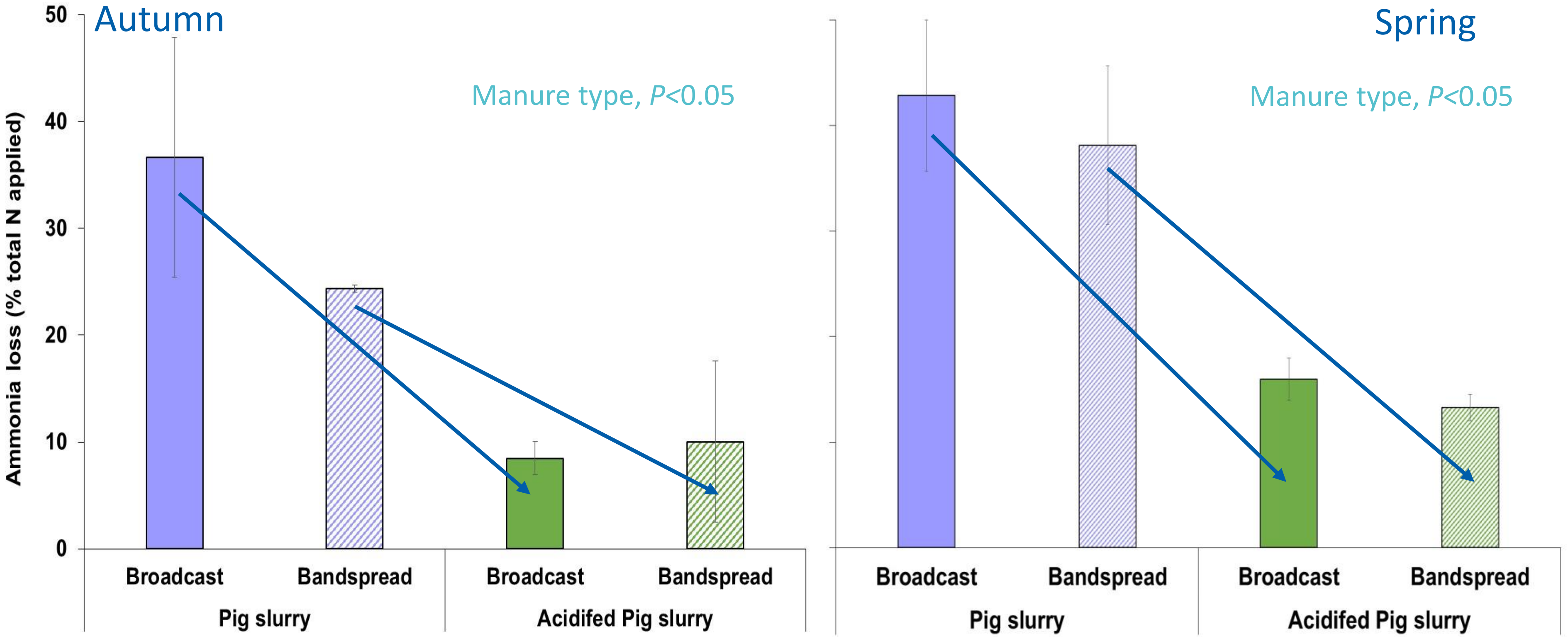
Treatments

- Acidified slurry (target pH 5.5)
- Arable sites - treatments applied using the ADAS small plot applicator
  - Surface broadcast
  - Trailing hose
- Grassland sites – slurry applied to simulate surface broadcast & bandspread
- Target application rate = 35 m^3, *c.*120 kg/ha total N
- Untreated control treatment – no nitrogen applied

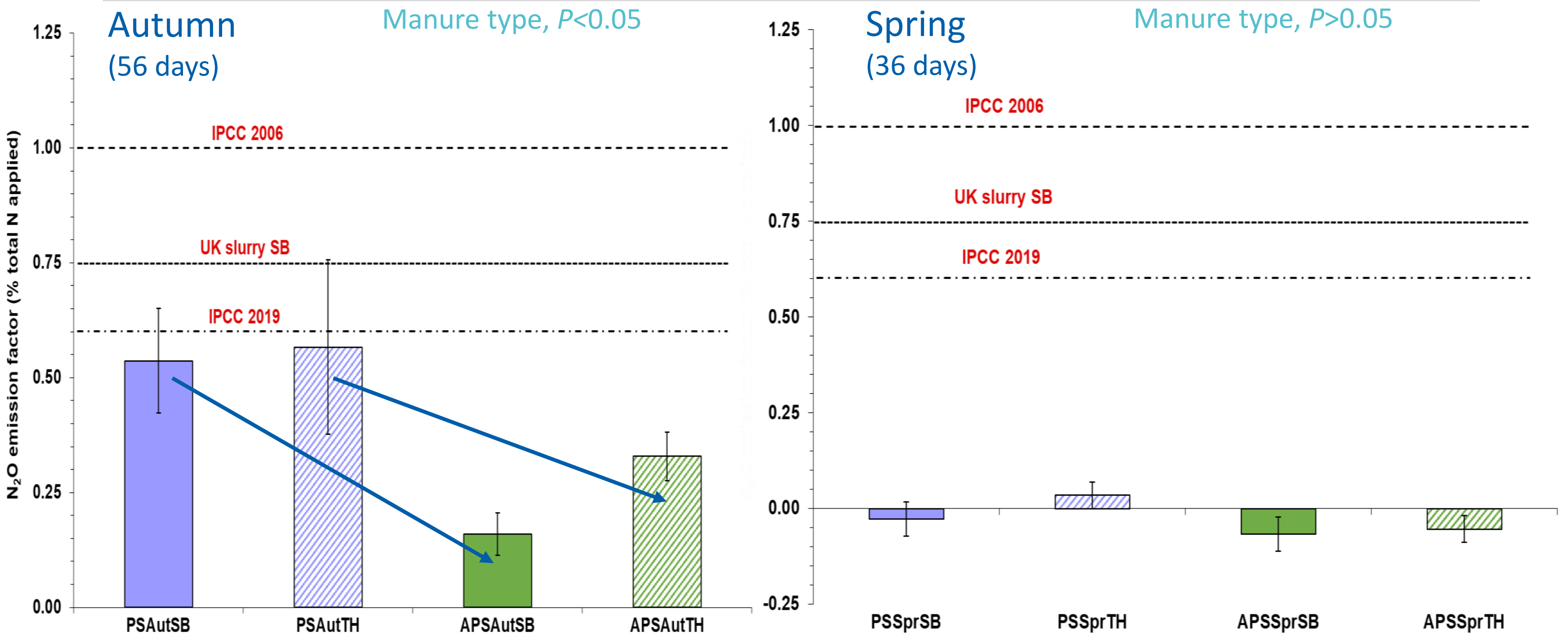
Direct N_2O & CH_4 measurements

- Static chamber technique
- 3 chambers/plot
- c.4 month measurement period
- Gas samples analysed by gas chromatography
- Soil mineral N & soil moisture (0-10 cm)

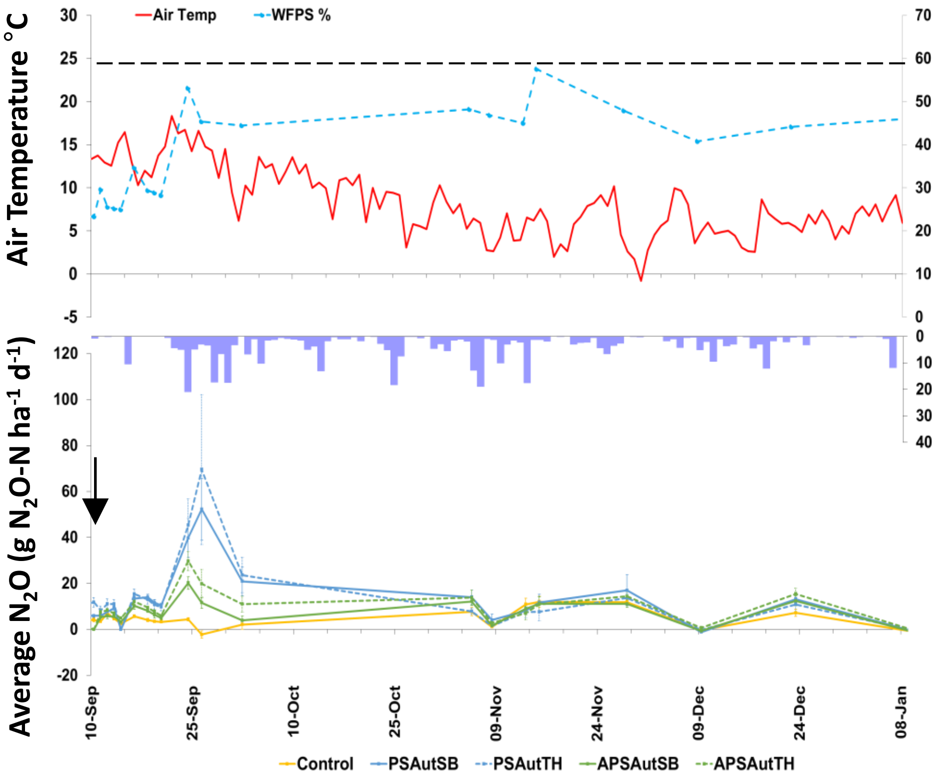
NH_3 emissions – Site 1, 2019/2020

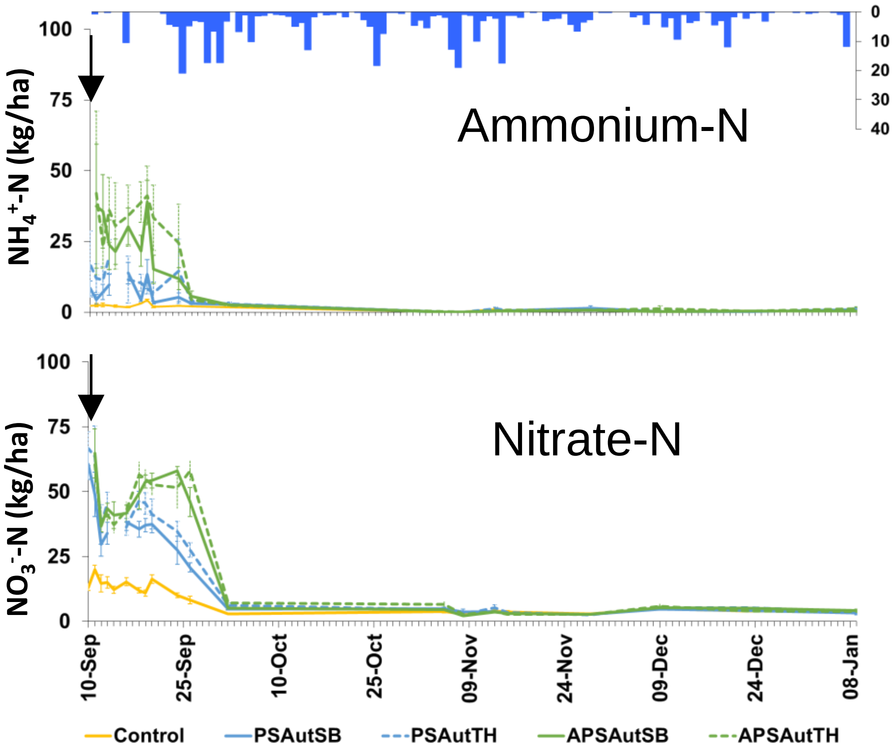


N_2O emission factors (*until background*) – Site 1, 2019/2020

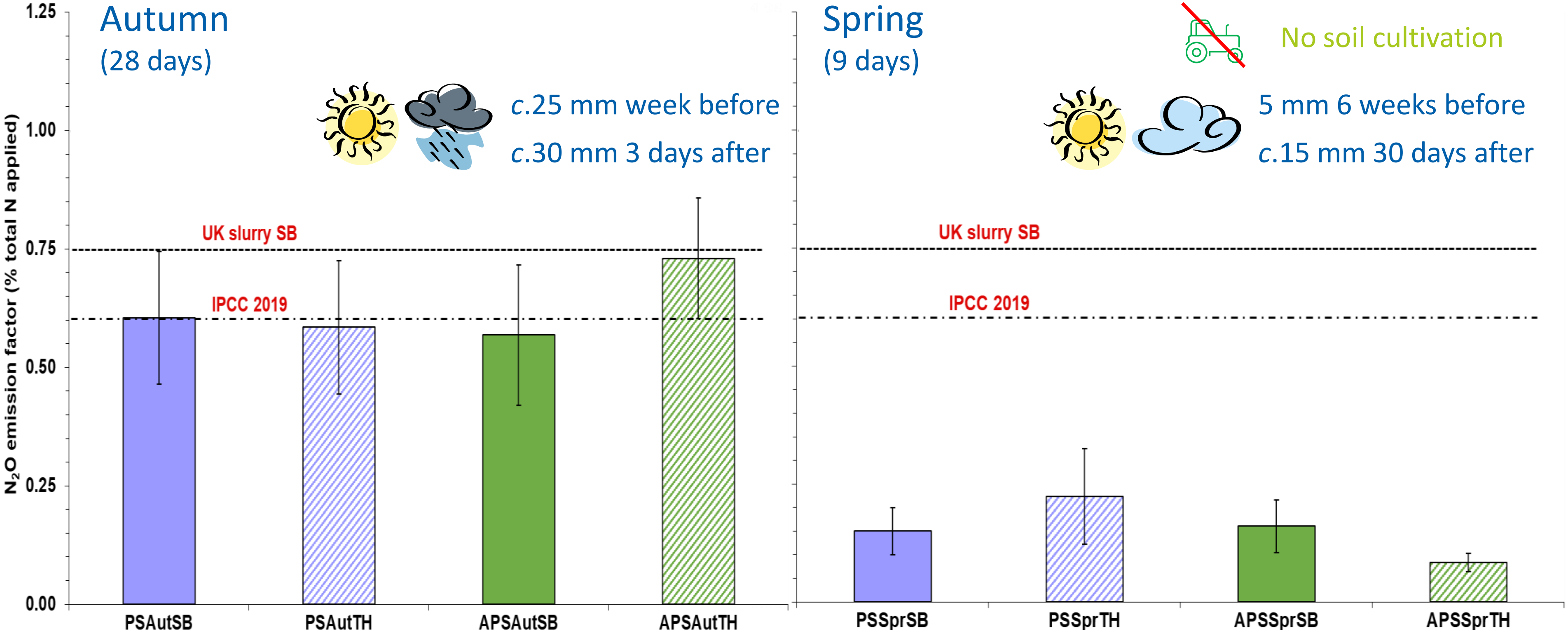


Daily N_2O emissions & SMN content – Site 1, autumn 2019



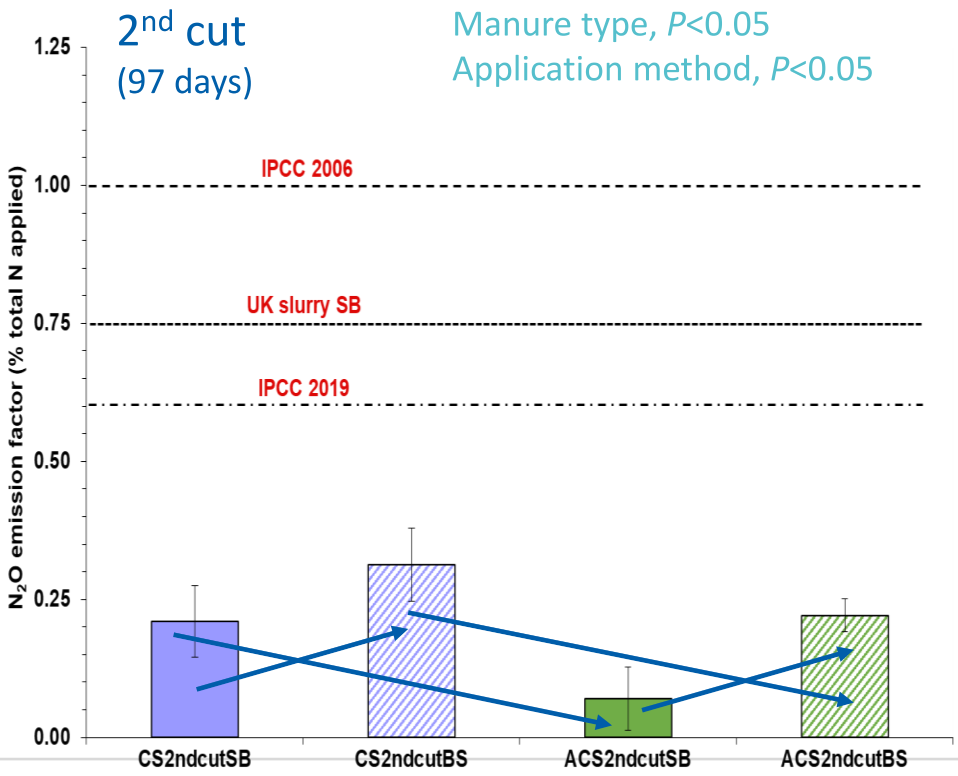


N_2O emission factors (*until background*) – Site 2, 2019/2020



Manure type, *P*>0.05

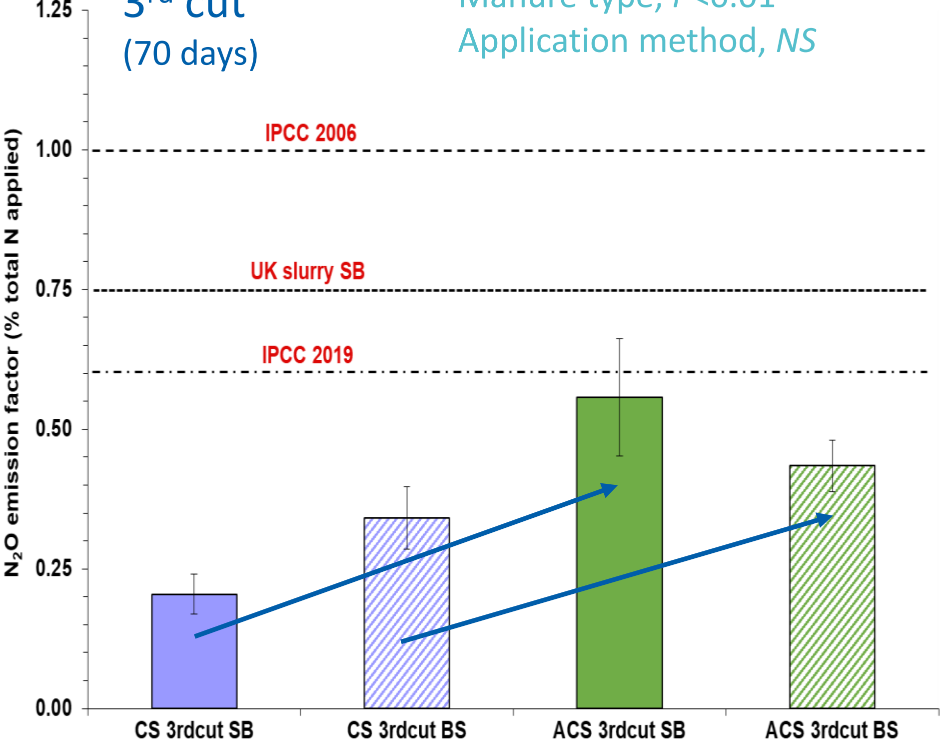
N_2O daily emissions & emission factors – North Wyke, 2nd cut 2021

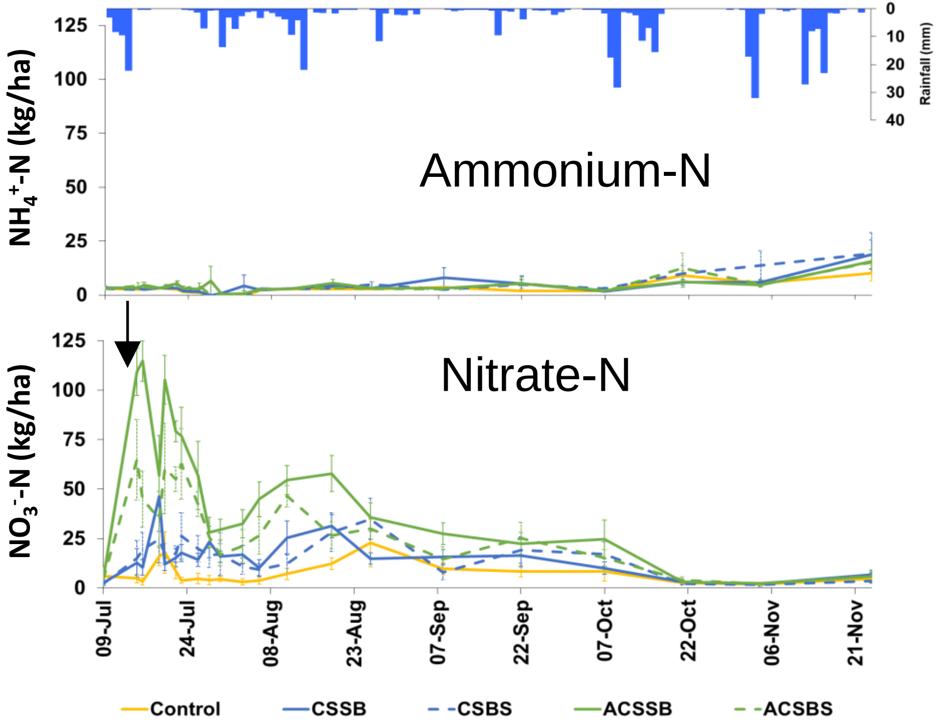


N_2O emissions & SMN content – North Wyke, 3rd cut 2021

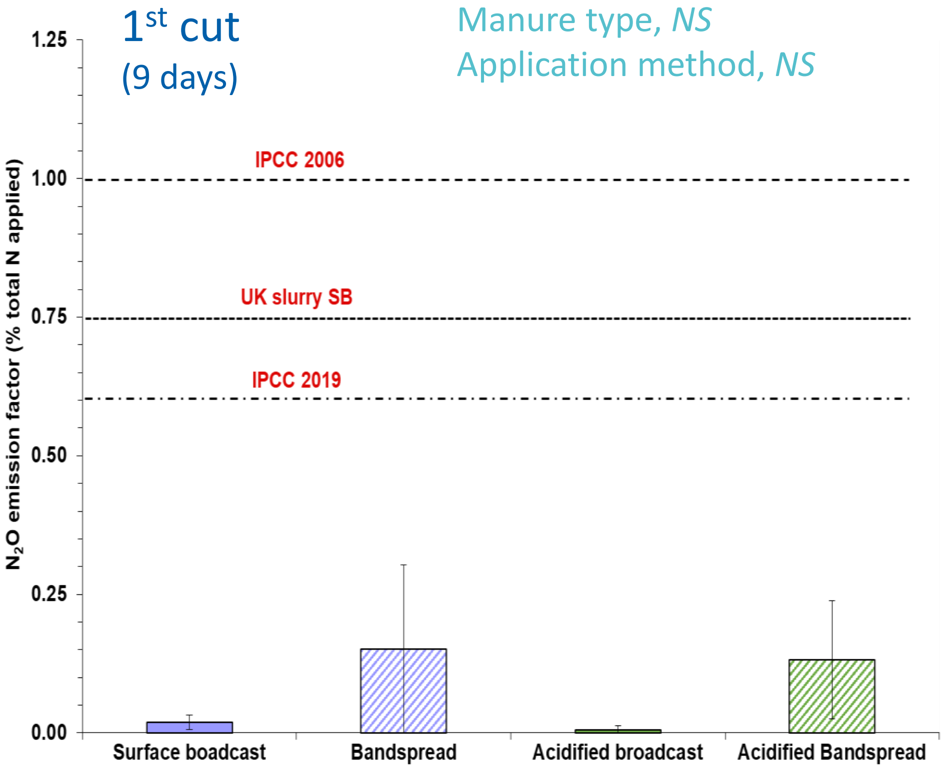
3rd cut
(70 days)

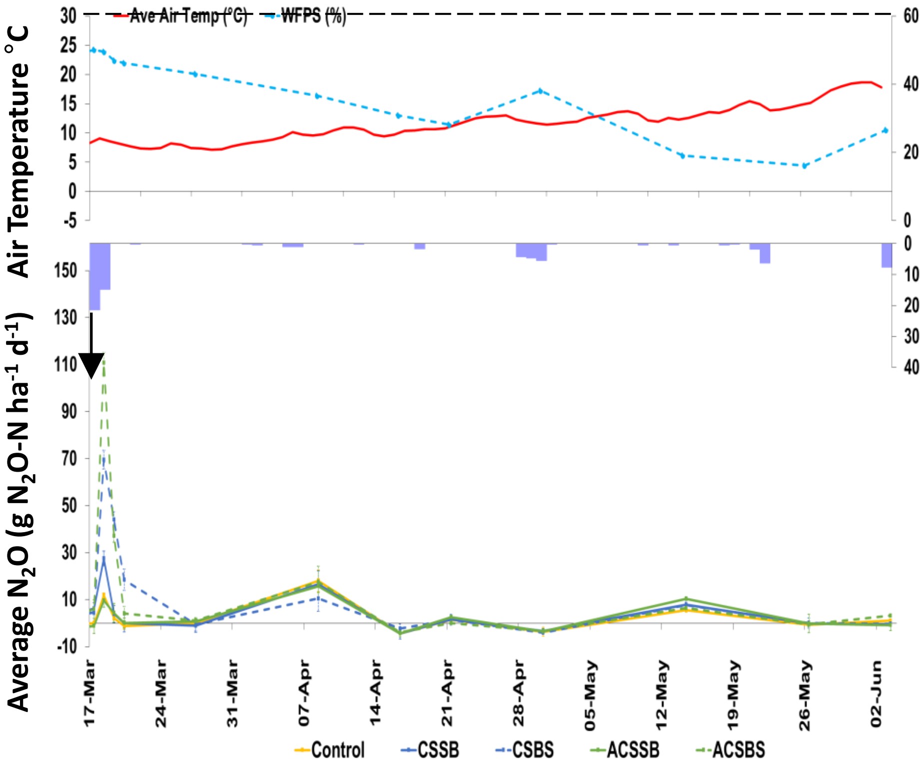
Manure type, *P*<0.01
Application method, *NS*





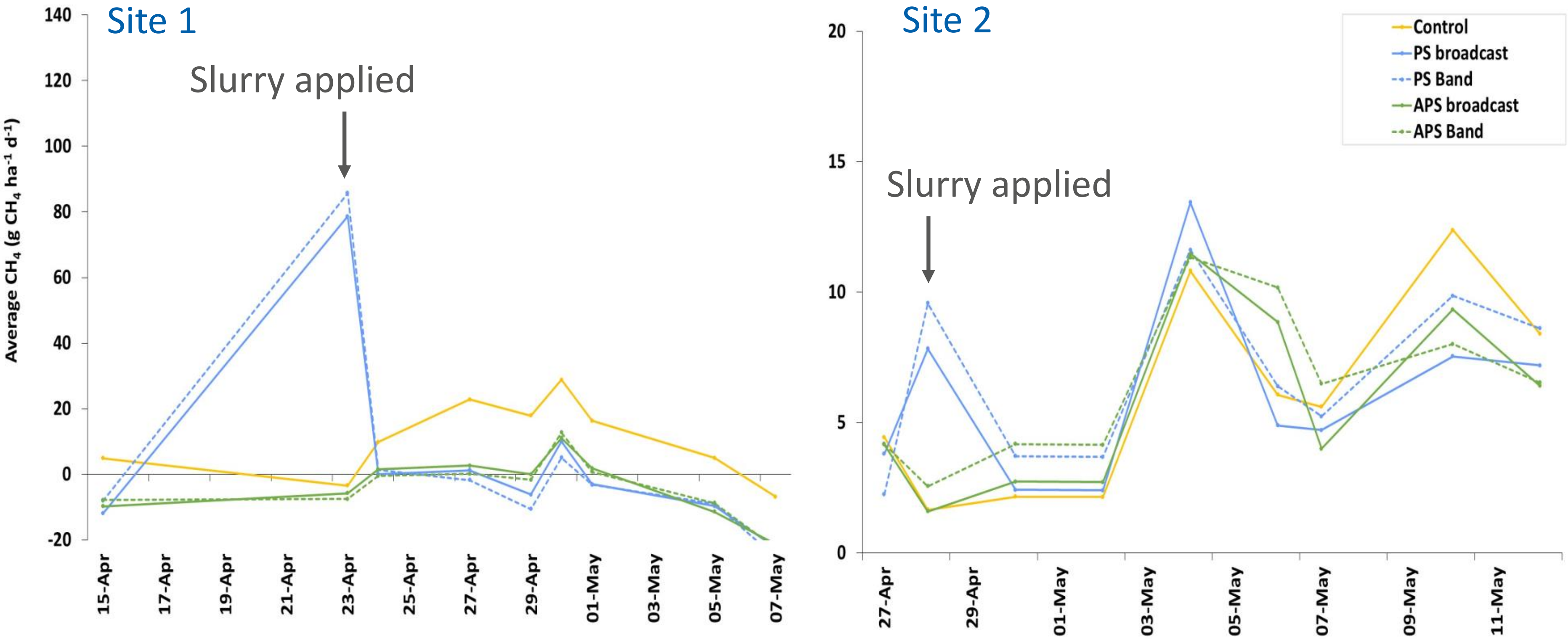
N_2O daily emissions & emission factors– Bangor, 1st cut 2020





Daily CH_4 emissions – Spring 2020

Manure type, *P*<0.05



Conclusion

- Slurry acidification at land spreading was inconsistent with an increase, decrease or no effect on N_2O emissions
- Likely reflects differences in slurry composition & soil conditions around slurry application
- Acidification consistently reduced CH_4 emissions up to two days after slurry application

Thank you

Department
for Environment
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