Nitrous oxide (N_2O) emissions from organic farming

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SAC Research

Content

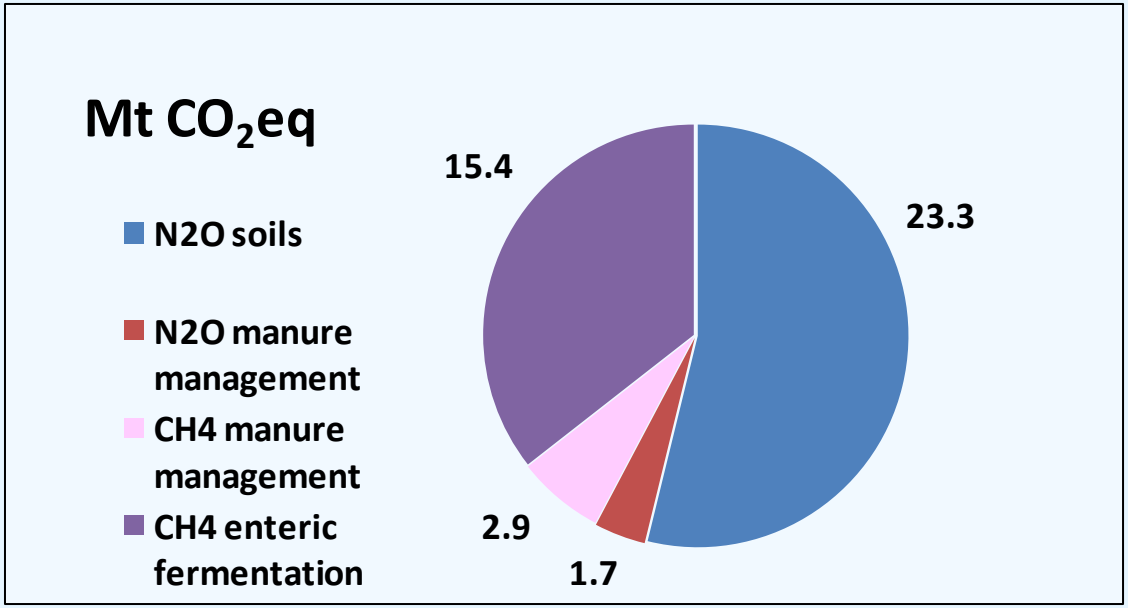
- How big is the problem in the UK?
- Where does N_2O come from?
  - some examples from organic systems
- What can we do about it?

How big is the problem?

- UK's agriculture sector contributes 6.74% GHG emissions to the UK total, and is the UK's single largest source of nitrous oxide (60.77%) emissions.
  - agricultural soils
  - agricultural manures

Greenhouse gas	GWP (t CO_2 equiv / t gas)
Carbon dioxide (CO_2)	1
Methane (CH_4)	23
Nitrous oxide (N_2O)	298 (depletes ozone)

UK Inventory data
(Misselbrook et al. 2009)



- Fertiliser N
- Manure N
- Crop residues
- Fixation
- Histosols
- Grazing returns
- Deposition
- Leaching/run-off


Logarden
Tulloch
Foulum
Paulinenaue
Maulde
NitroEurope
Arable network
Beano
El Encin
200
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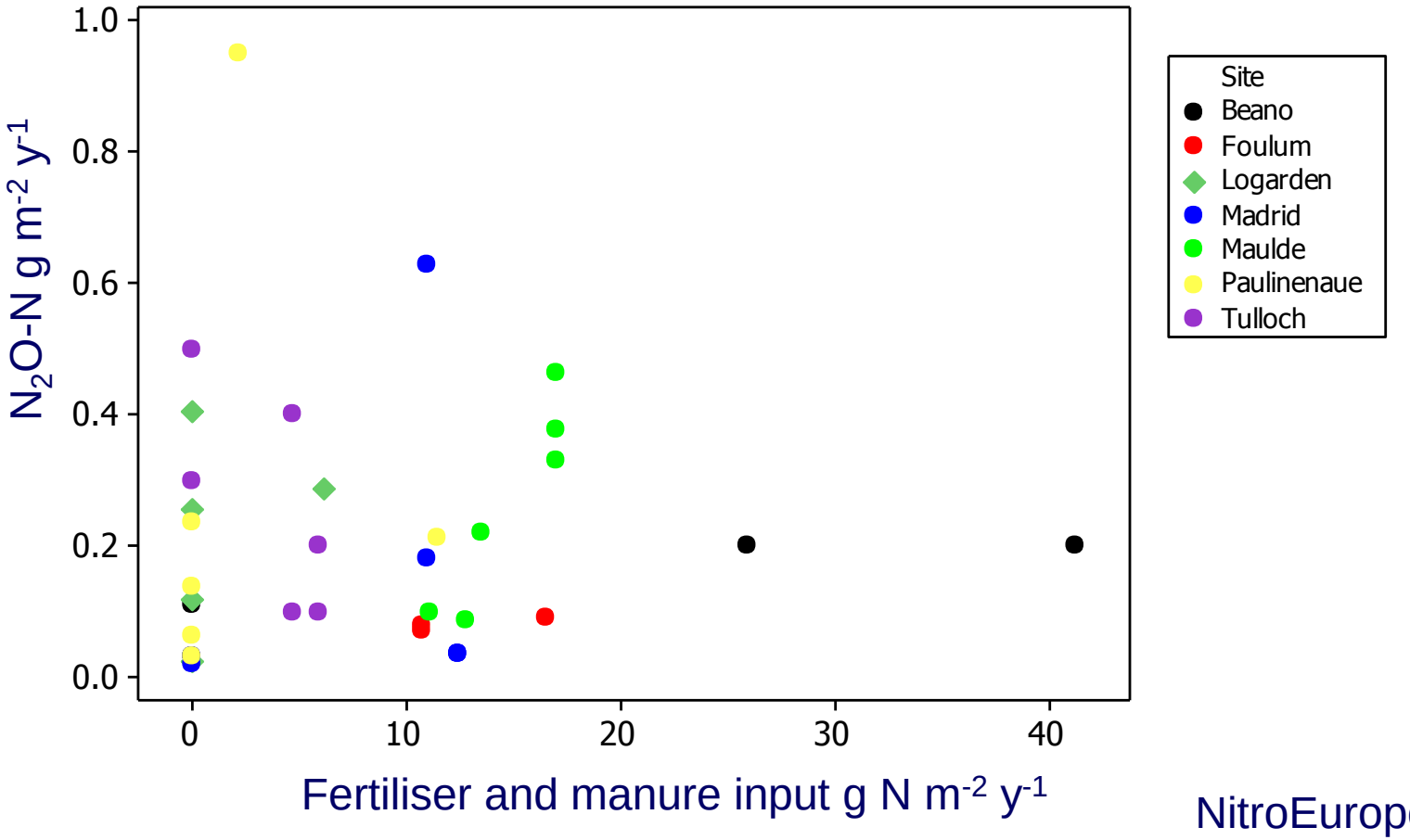
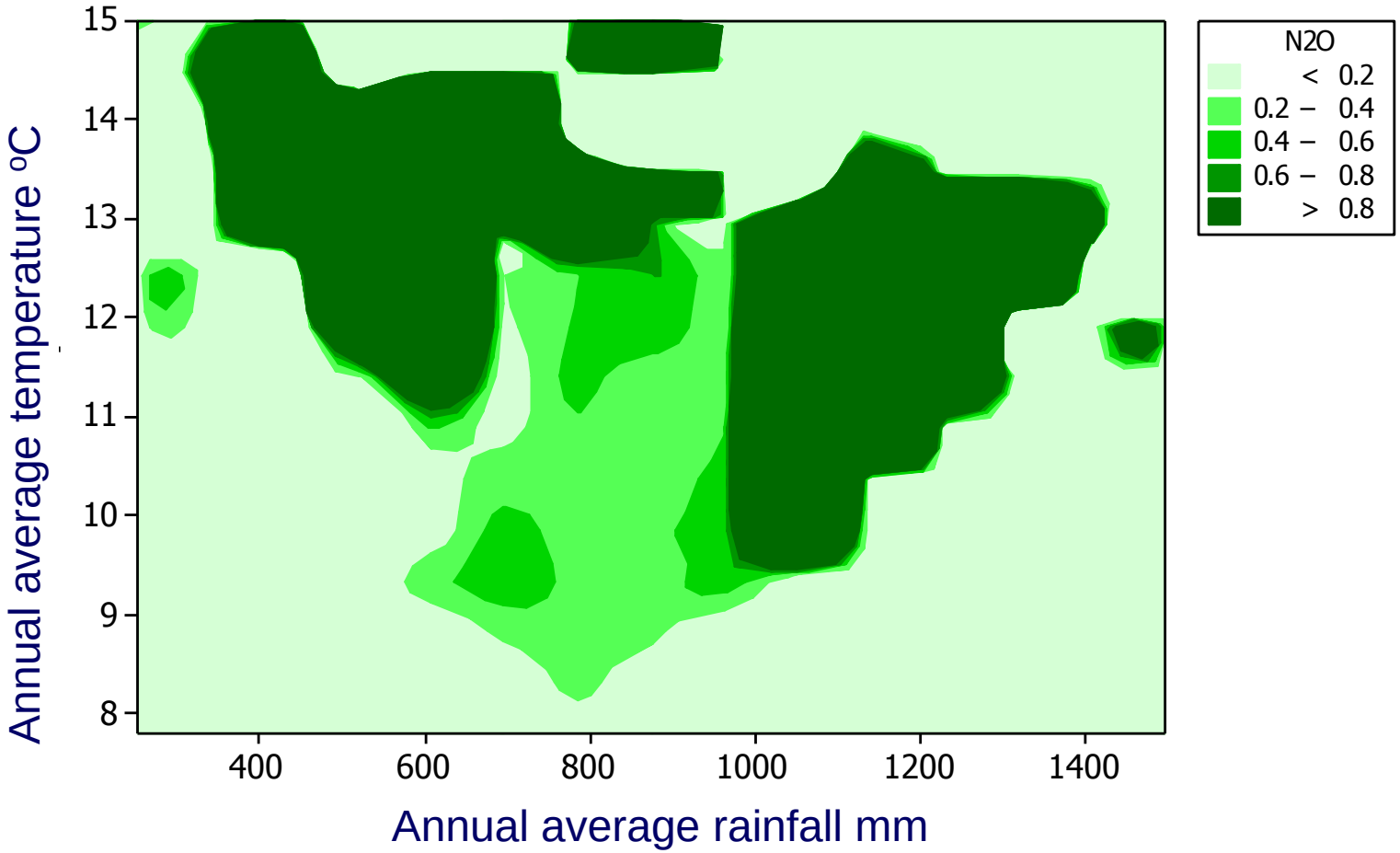
No simple relationship between N input and nitrous oxide flux

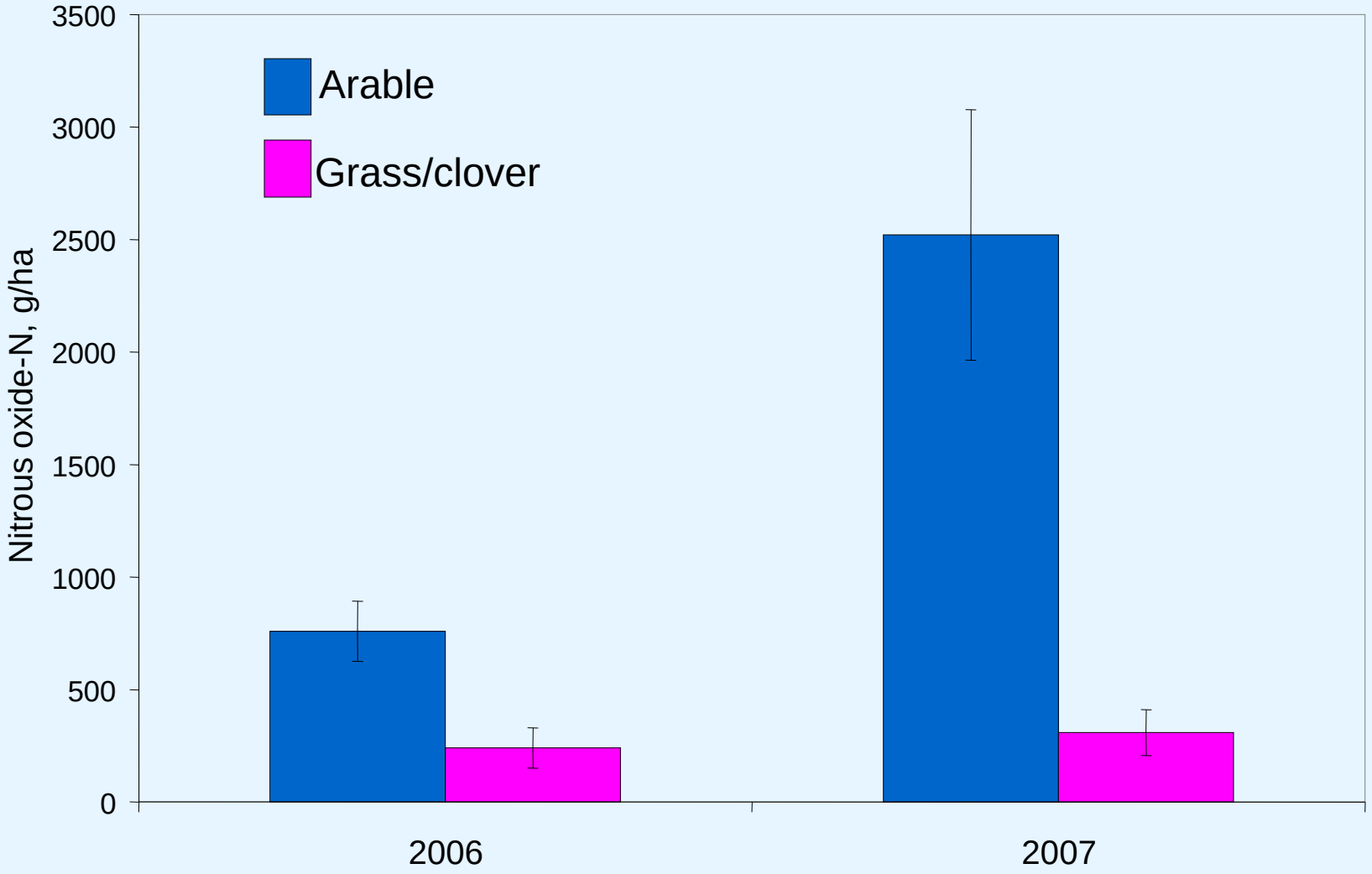


NitroEurope data

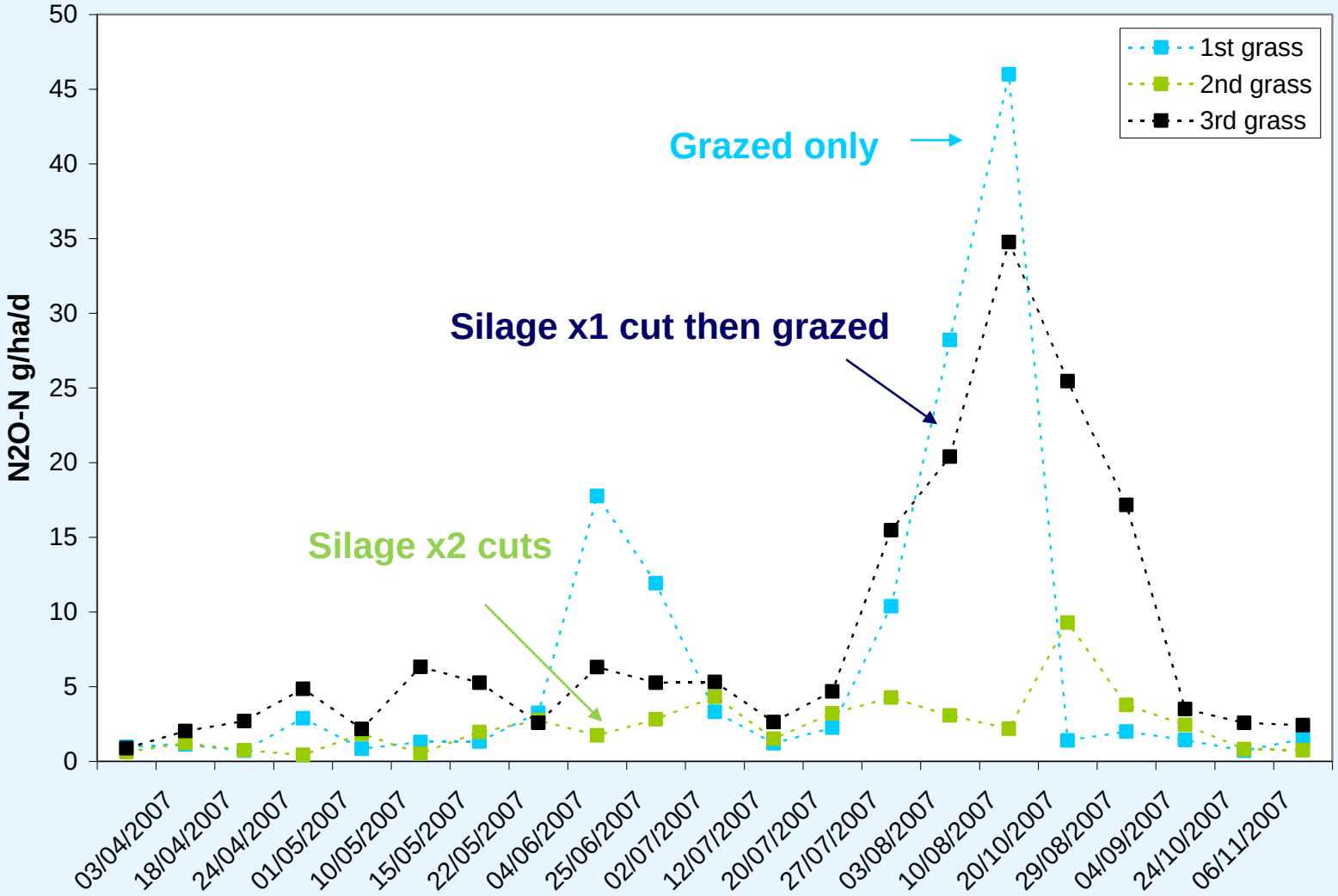
Nitrous oxide and climate



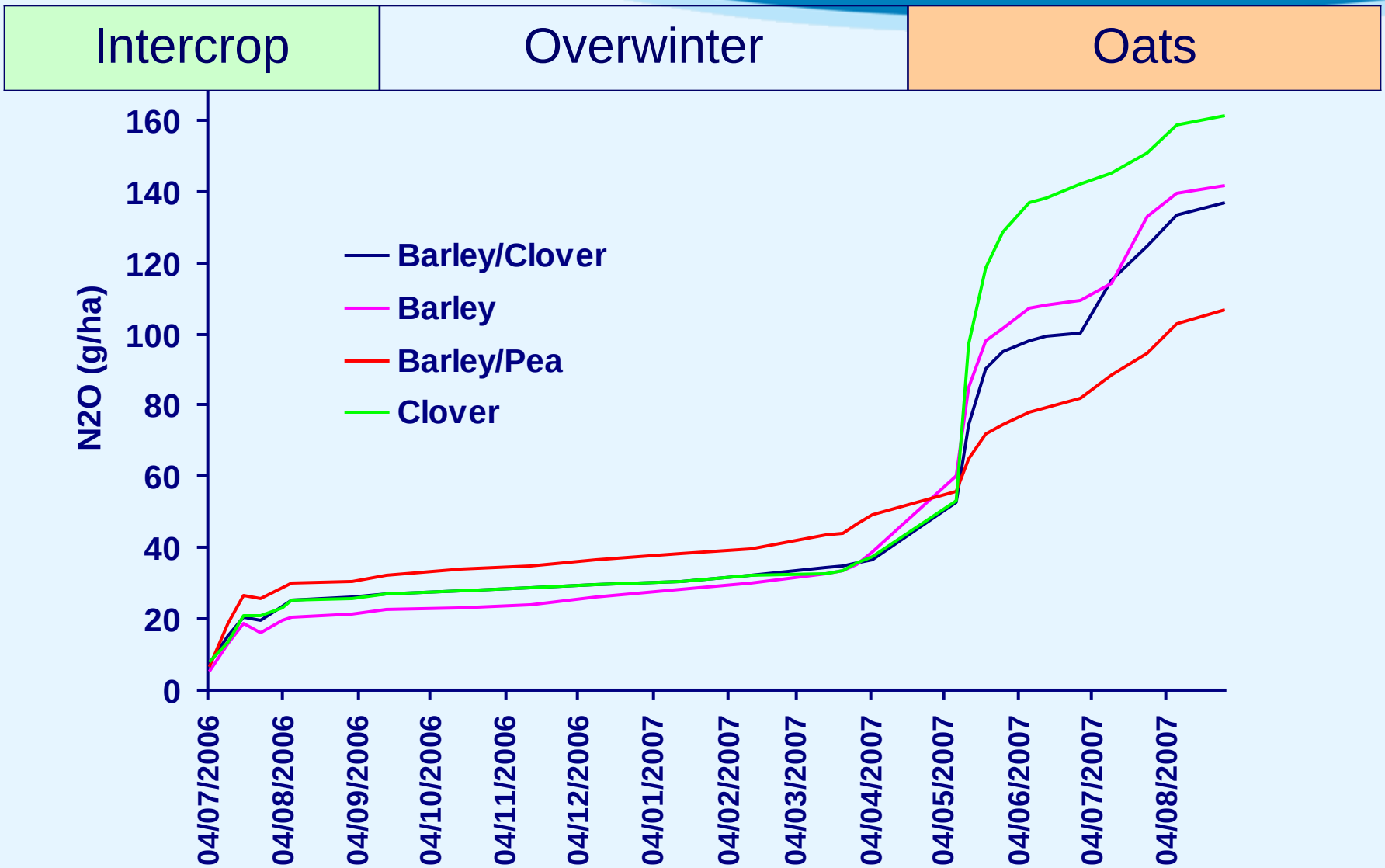
Year to year variation is large –
wet conditions increased nitrous oxide loss between early April and early July at Aberdeen



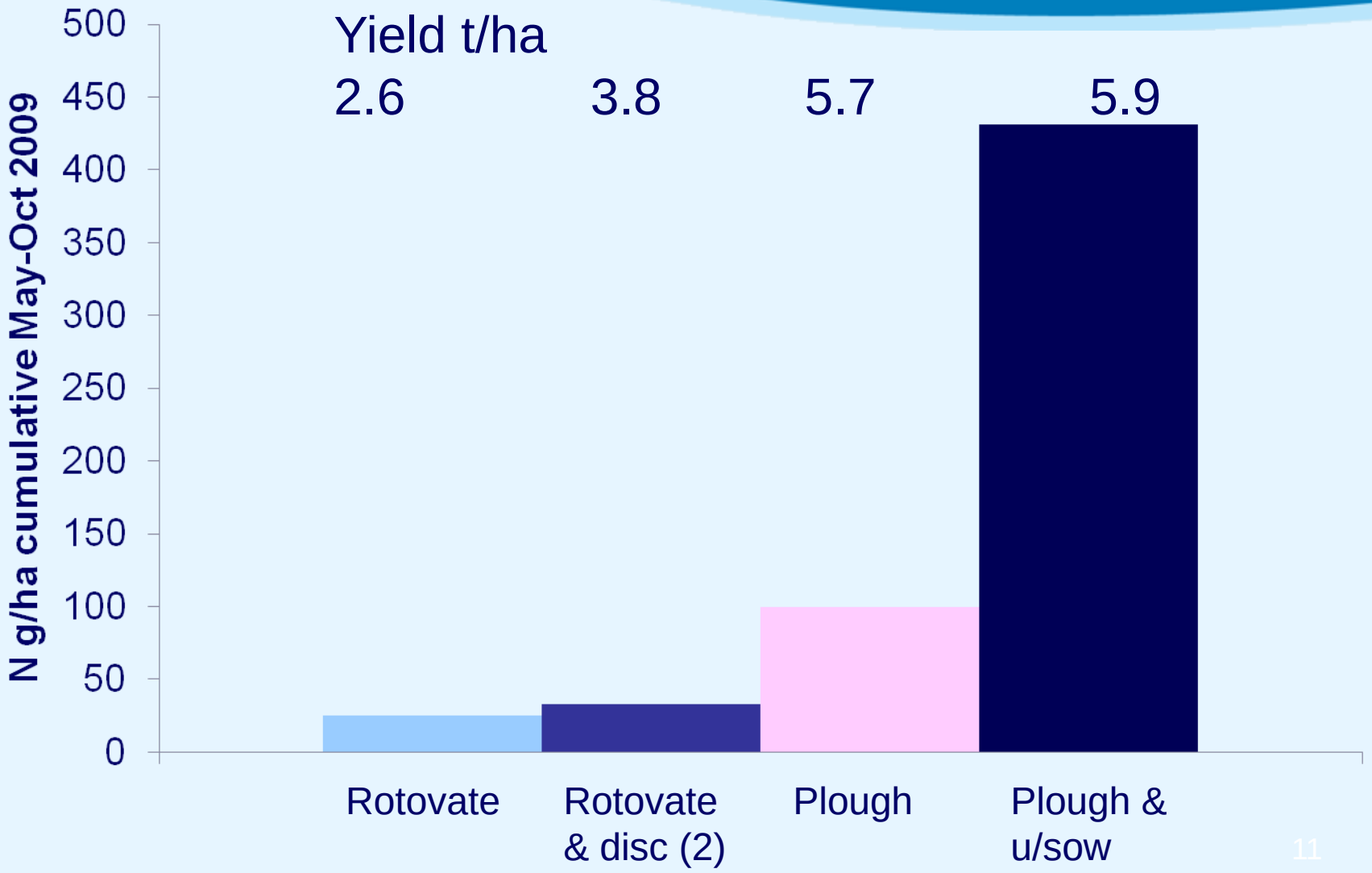
Management and N_2O fluxes



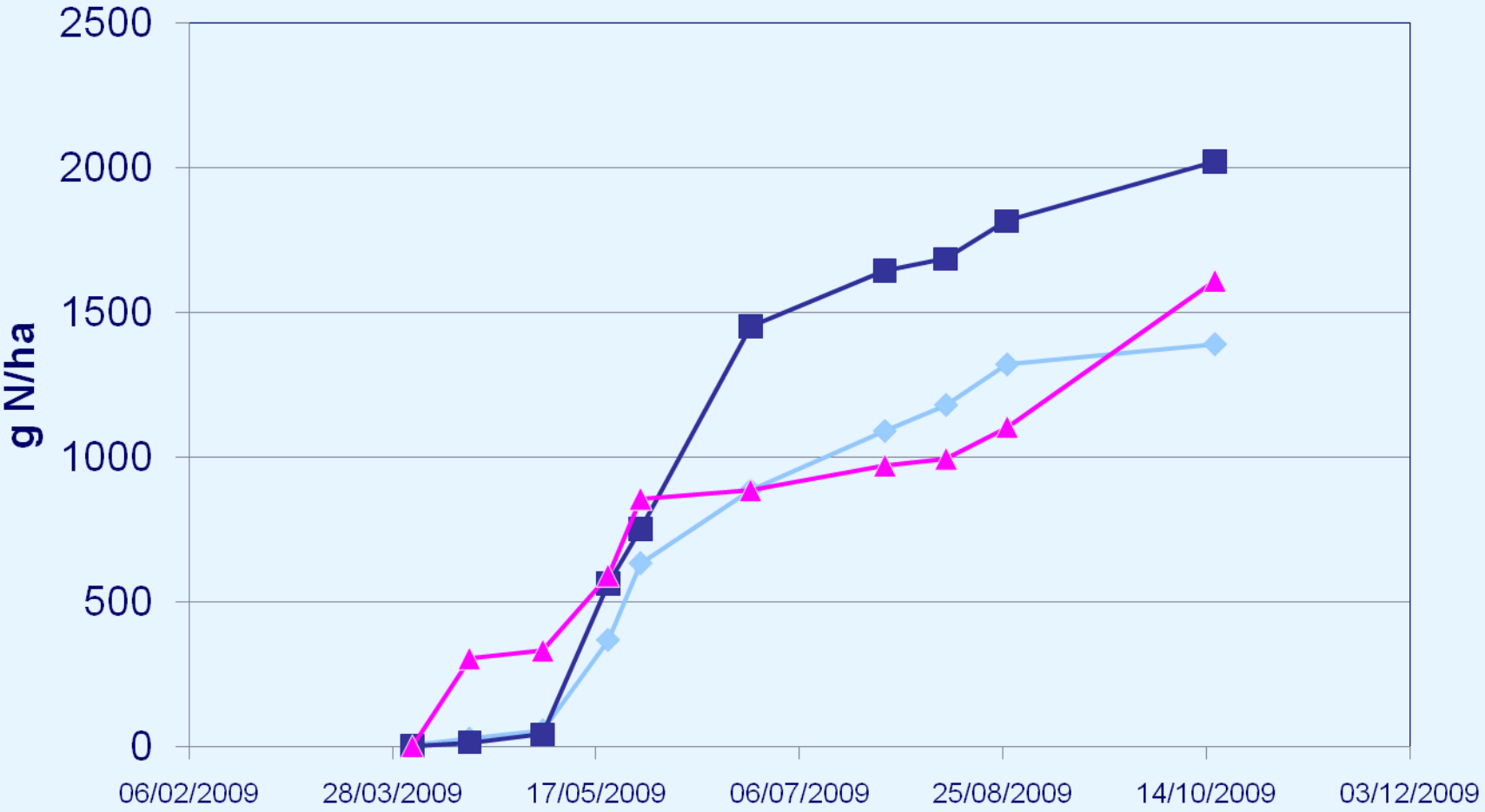
Cumulative N_2O Emissions from cropping systems



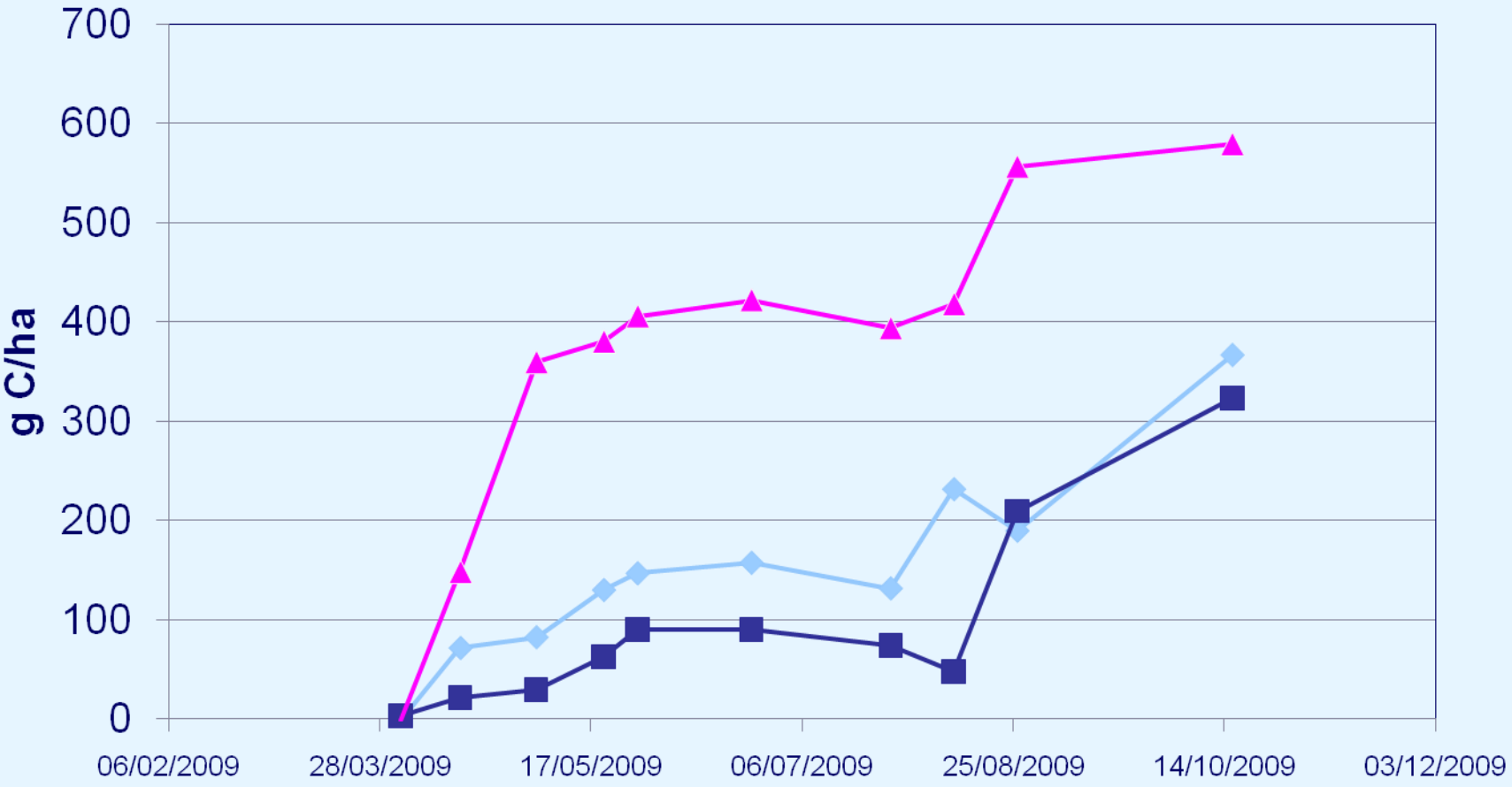
N_2O losses from spring barley following different tillage treatments



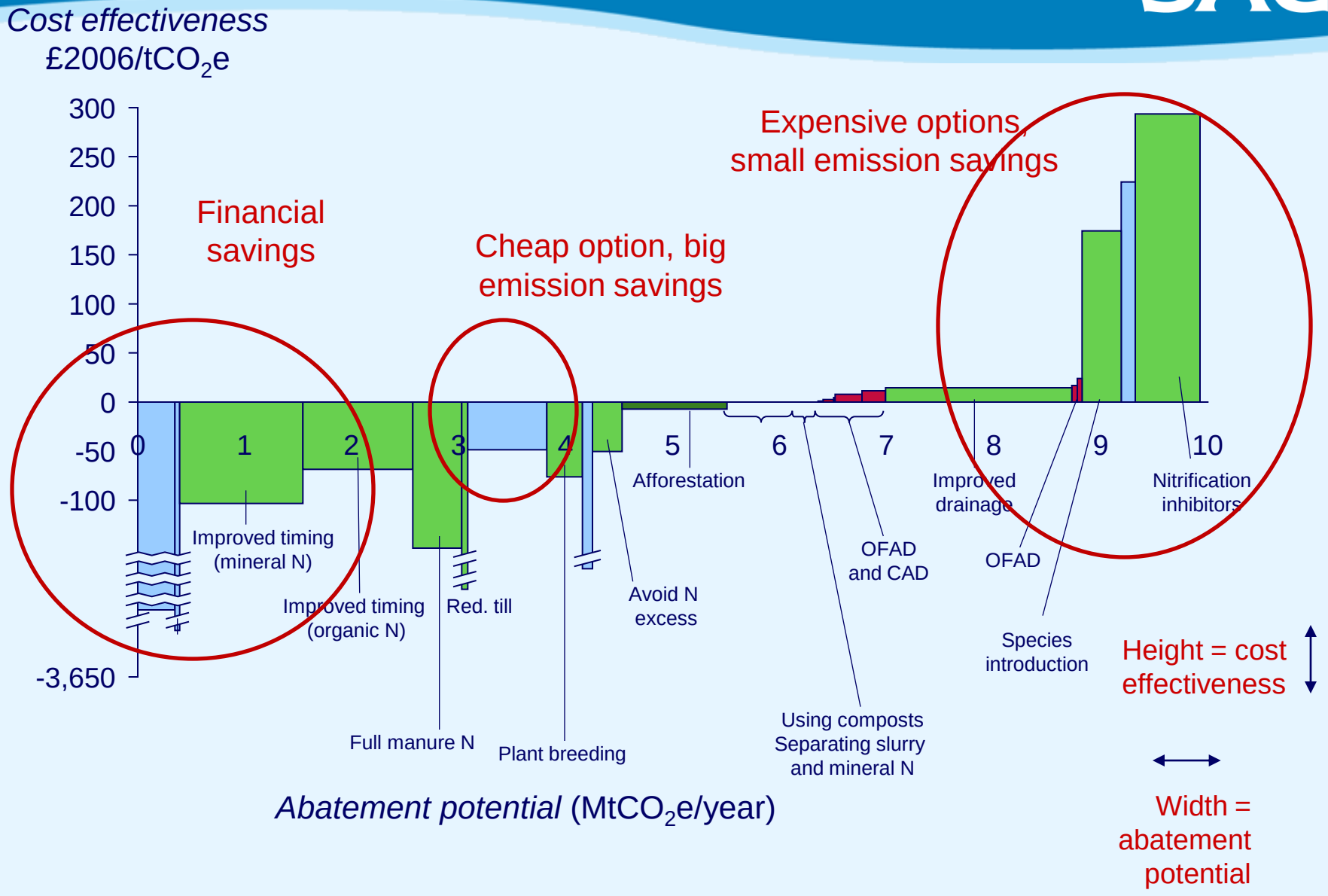
Cumulative N_2O emissions from 3 bean varieties



Cumulative CH_4 emissions from 3 bean varieties



Marginal Abatement Cost Curve (2022, CFP, 3.5%)



Results for crops/soils measures
(2022, CFP, 3.5%)

Measure	ktCO2e abated	CE [£2006/tCO2e]
Improved Timing, Mineral N	1,150	-103
Improved Timing, Organic N	1,027	-68
Fully accounting for manure N	457	-149
Reduced tillage	56	-1,053
Improved N-Use Plants	332	-76
Avoiding N Excess	276	-50
Using Composts	79	0
Separating Slurry and Mineral N	47	0
Improved Drainage	1,741	14
Species Introduction	366	174
Nitrification inhibitors	604	293
Controlled release fertilisers	166	1,068
Reducing N Fertiliser	136	2,045
Adopting Systems Less Reliant On Inputs	10	4,434
Biological fixation	8	14,280

Concluding thoughts

- Plough grass/clover in spring not summer
- Land drainage prevents waterlogging and compaction
- Reduce xs N in livestock diet and thus reduce excreted N
- Variety selection could be important in the future
- Composts and straw based manures are good

Beware trade-offs
Mitigation measures must be cost-effective

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Success through Knowledge