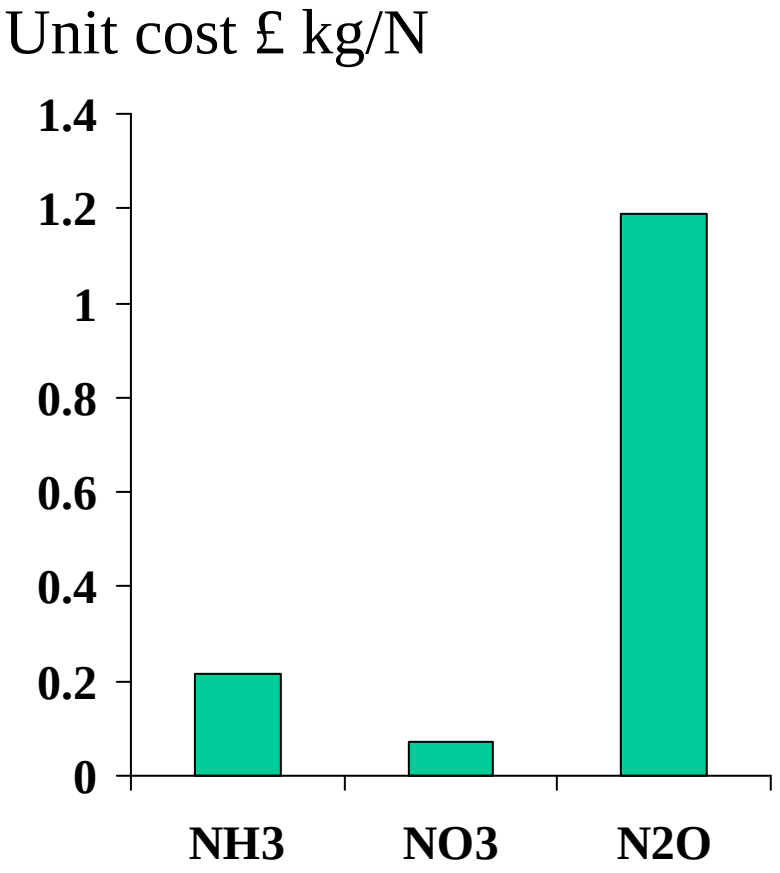
Objective of talk

- To evaluate abatement of N losses with respect to the environmental costs
- cost estimates based on those of Pretty et al
- those costs may be regarded as outdated
- but more recent cost estimates have not dealt with all N losses



Relevance to workshop

- Quantify **nitrogen budgets/balances**
- economic **effectiveness of nitrogen abatement measures**
- assessment of **nitrogen surpluses** in agricultural systems
- **holistic approach** – but this often seems to ignore crop requirements and uptake
- **emissions** of reactive-N
- **abatement interactions**

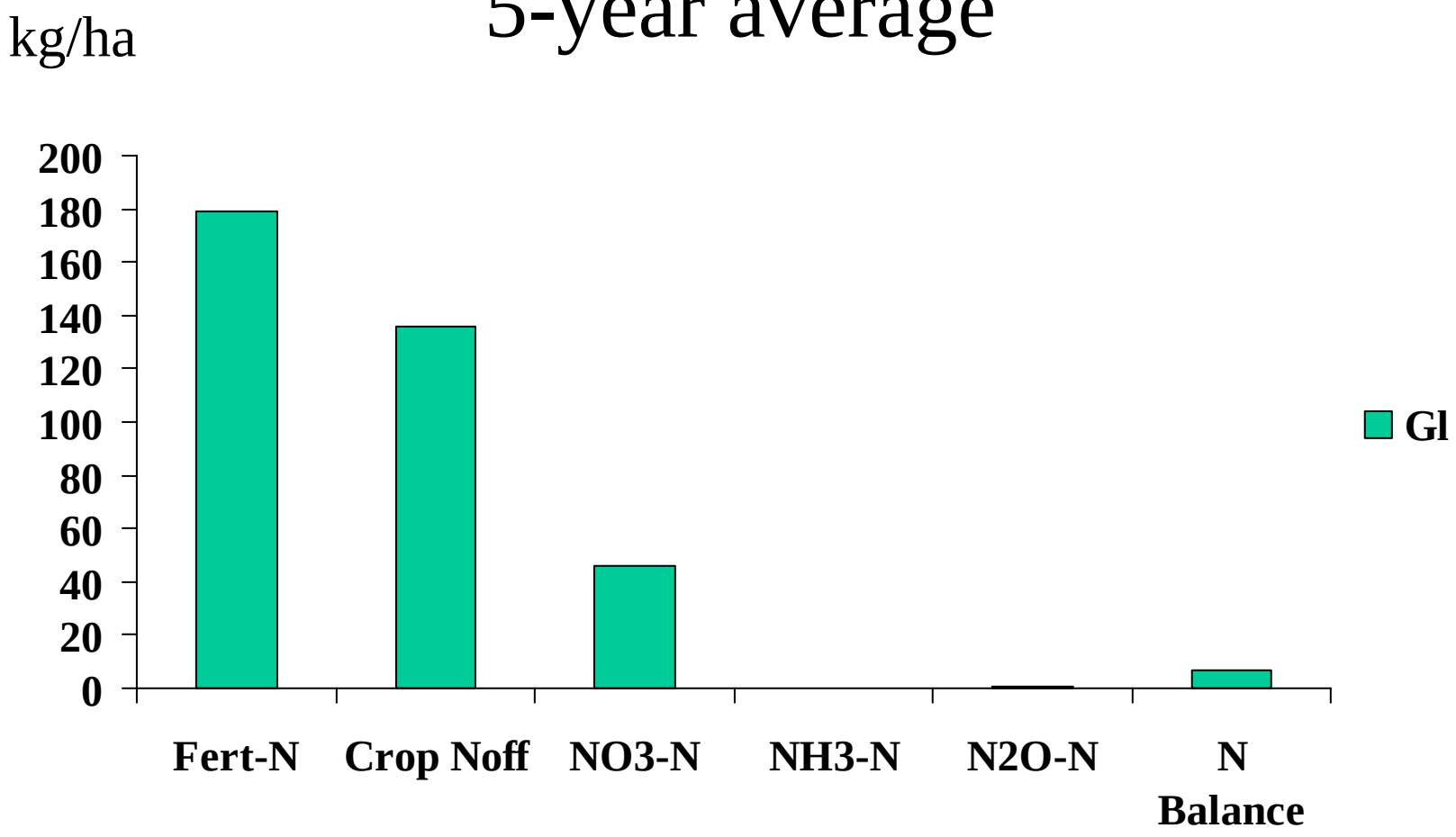
Measurements of N inputs/ outputs and N balance

with R Harrison, S Ellis and
R Thorman

NT 1833 - sites

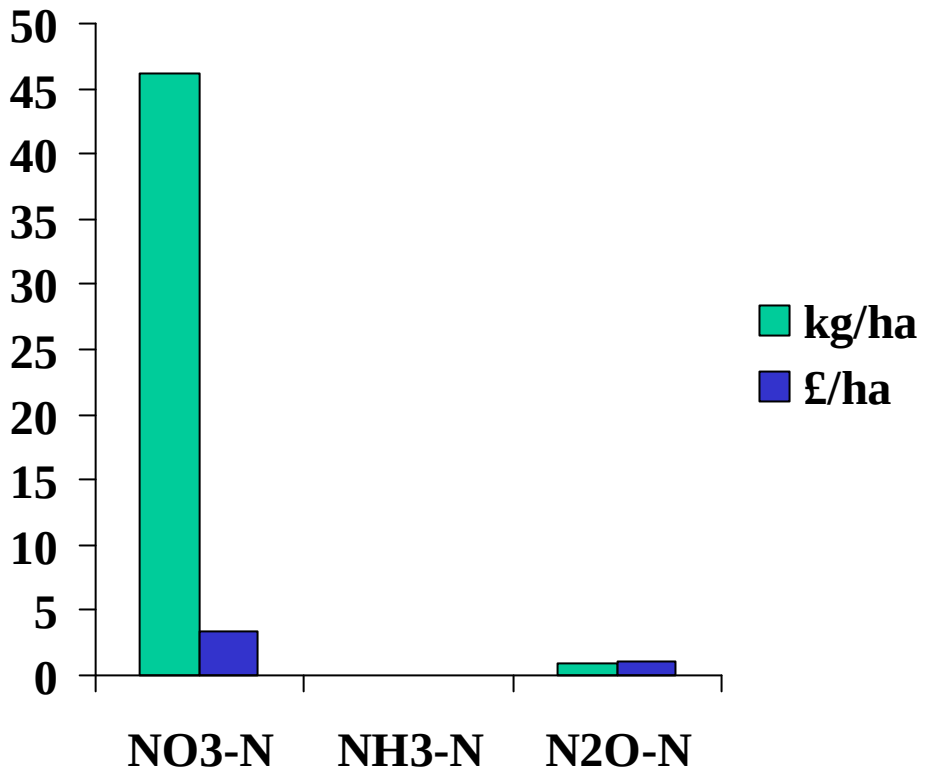
- ADAS Gleadthorpe
  - loamy sand over sand
- ADAS Terrington
  - retentive alluvial silt
- measurements from two fields per farm over 5 years
  - potatoes, sugarbeet and winter cereals
- no livestock manures applied

Sandy free-draining soil – 5-year average



Sandy free-draining soil

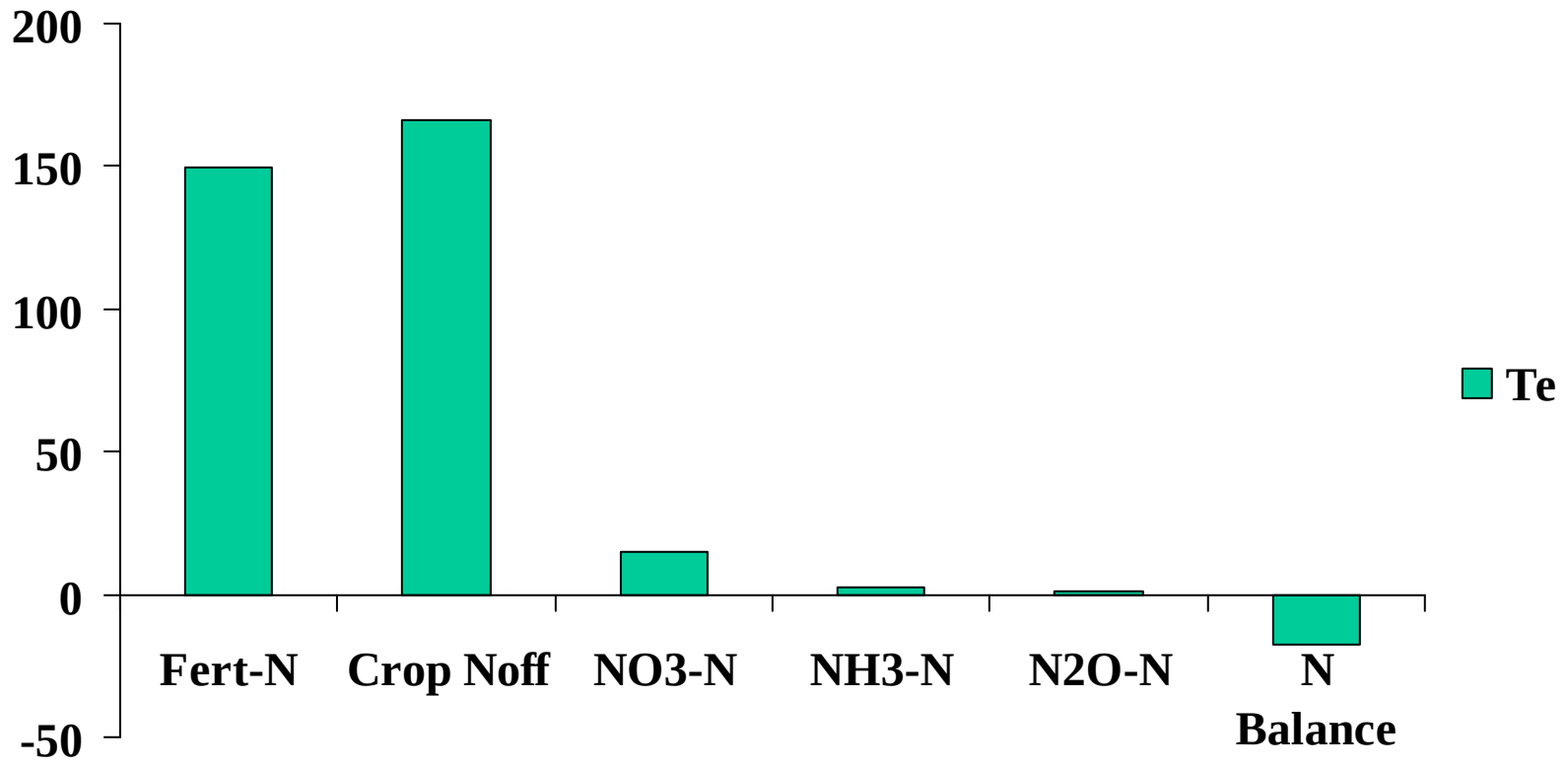
- Unit costs
- NO_3^-,
  - £0.073/kg N
- NH_3,
  - £0.215/kg N
- N_2O,
  - £1.190/kg N



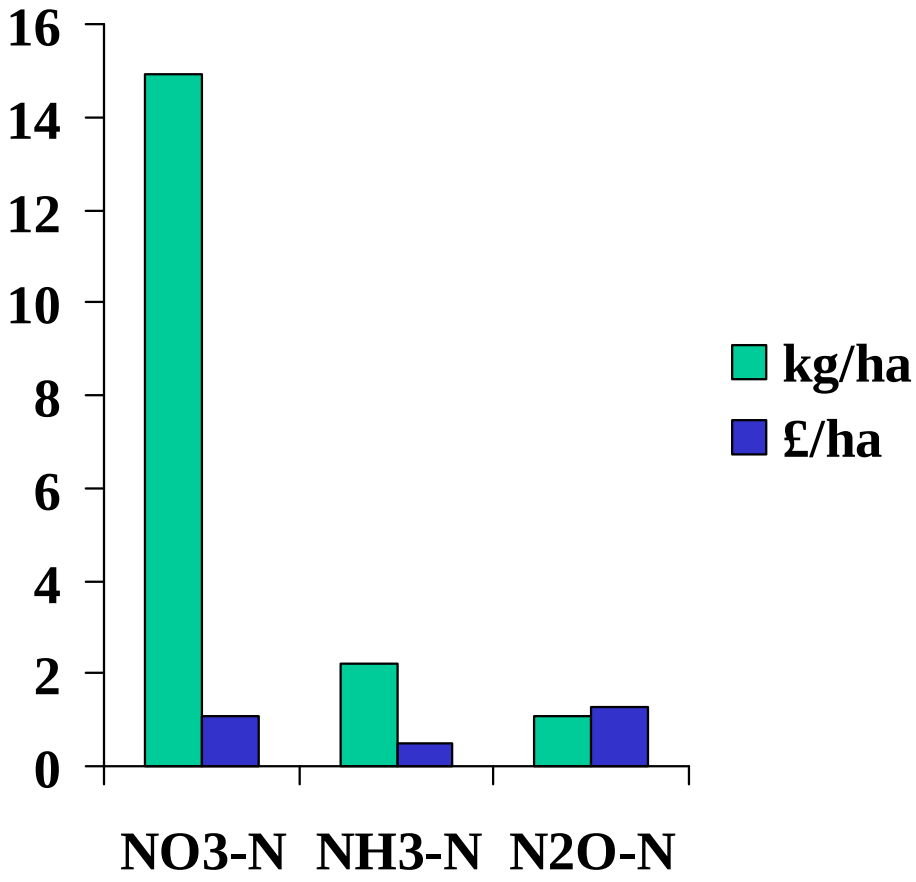
Silty, retentive soil –

5-year average

kg/ha



Silty, retentive soil



Conclusions

- When no manures are applied, NO_3^- losses dominate
- may even be the most costly loss
  - despite small unit cost
- since the N balance is small, or even negative, scope for reductions in N application very limited

Impact of ammonia abatement on nitrate leaching

with S Anthony and S Humphries (ADAS)

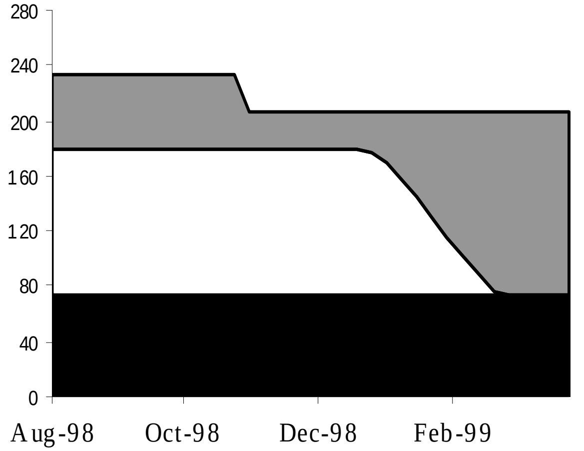
Impact of NH_3 abatement on NO_3^- leaching

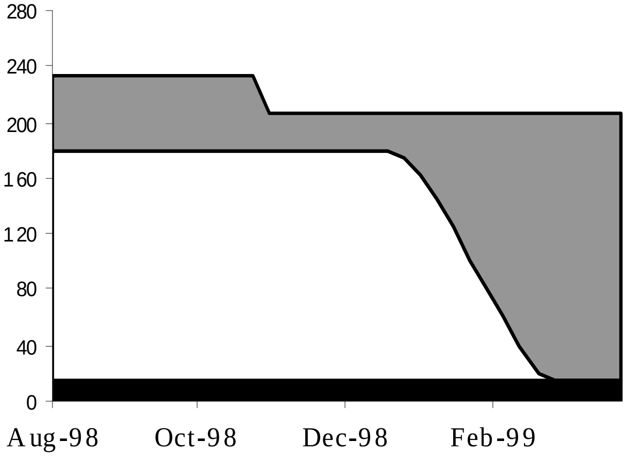
- Simulations using the MANNER model
- assess the impact of reduced-emission application of slurries and manures on nitrate leaching
- from August to April

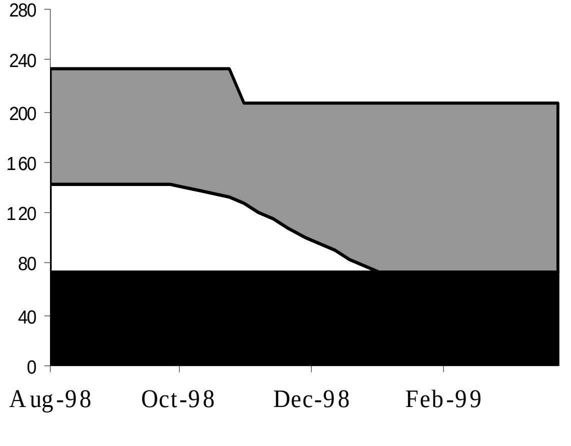
WA0711 - results:

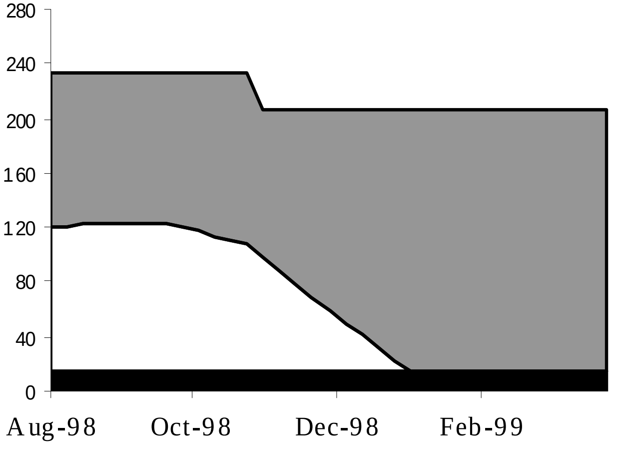
broiler manure, Lancs and Suffolk

black=NH_3, white=NO_3, kg/ha









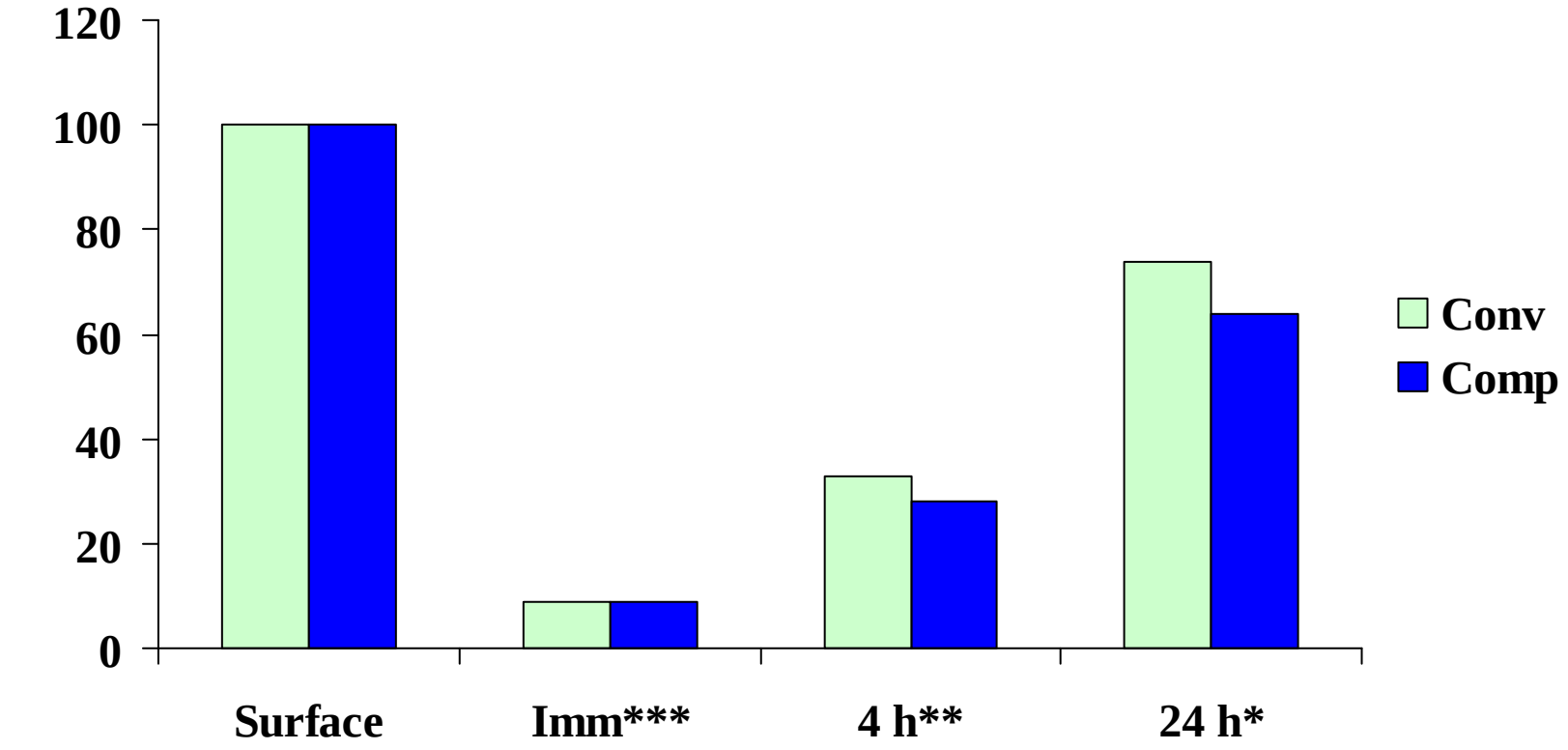
Conclusions

- NH_3 emissions can be reduced without increasing NO_3^- leaching
- the capacity to do so will be limited due to the dominance of Autumn-sown crops
- but, the environmental cost of NO_3^- is << than NH_3
- so the environmental costs will always be reduced

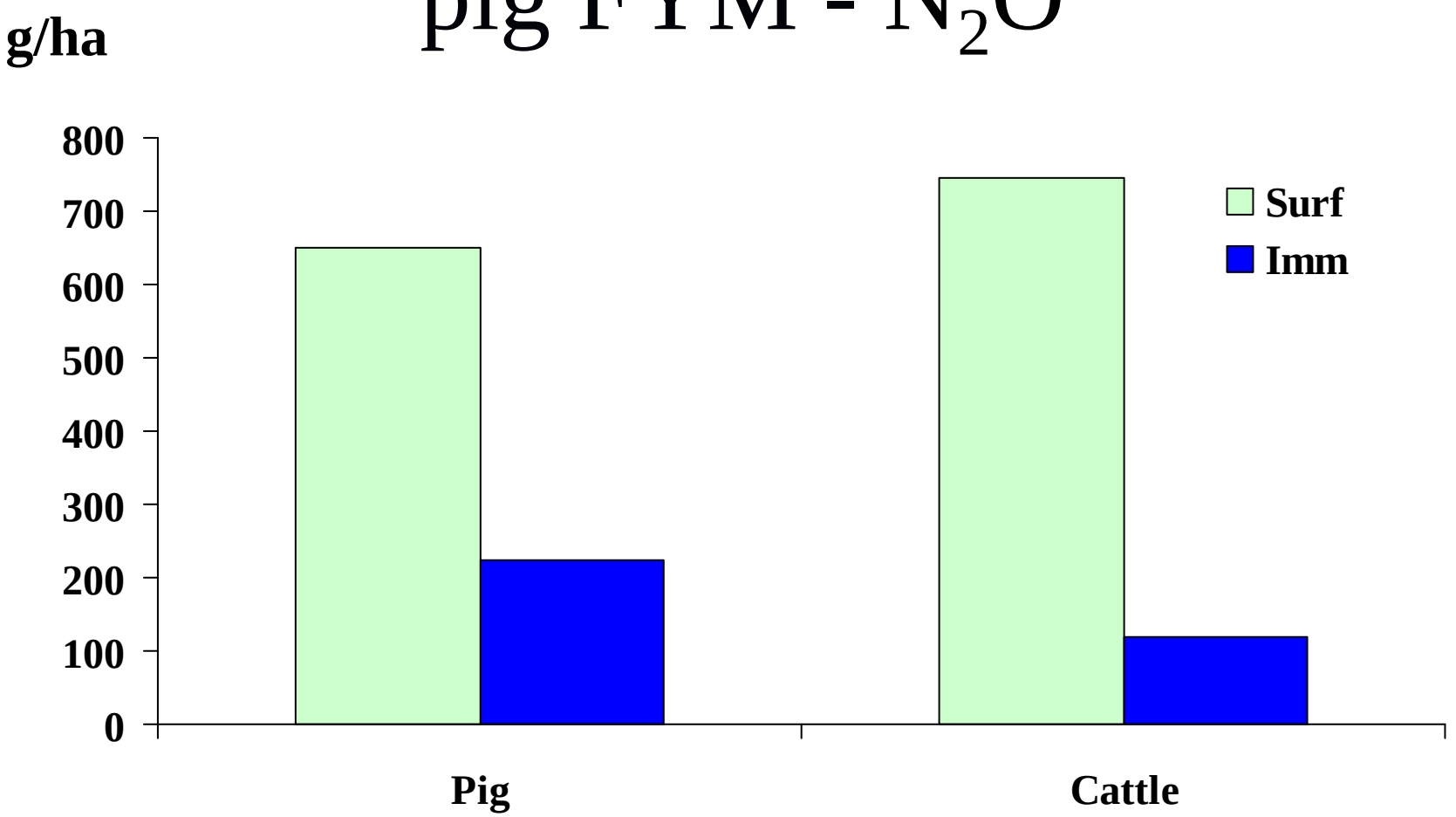
Impacts of NH_3 abatement on N_2O emissions

with S Ellis and D Chadwick (IGER)

WA 0707 - Incorporation results pig FYM - NH_3



WA 0707 - Incorporation results pig FYM - N_2O



Conclusions

- NH_3 abatement does not always increase N_2O emissions

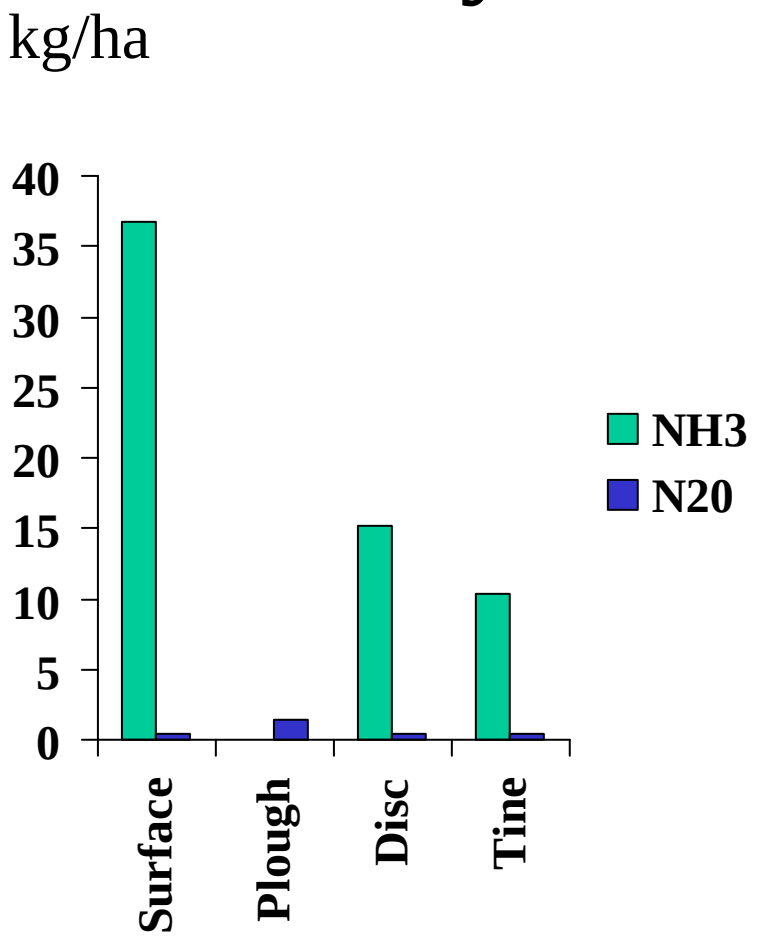
Impacts of NH_3 abatement on N_2O emissions

with R Thorman (ADAS), TH Misselbrook and S Yamulki (IGER) and F Aller Alvarez

ES 0116 - objectives

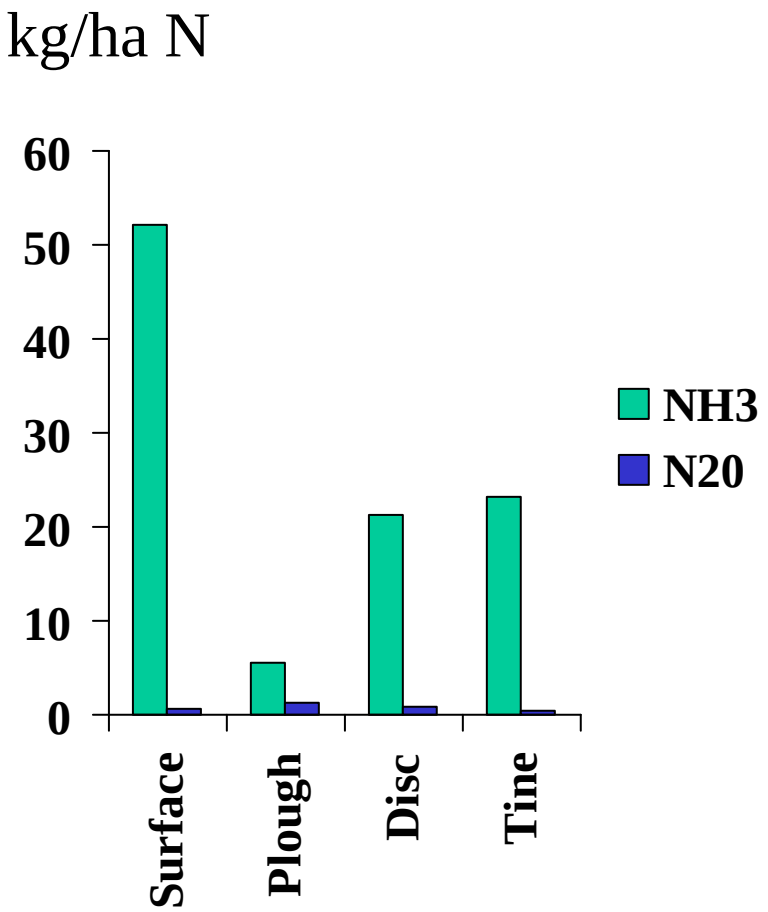
- To quantify in controlled field experiments the effectiveness of incorporating solid manure into soil by plough, discs or tines as a means of NH_3 abatement
- to estimate the effects on NO_3^- leaching
- to measure the effects on N_2O emissions
- to measure the effects on yield and N uptake of the subsequent crop

Sandy free-draining soil



- Late winter application
- significant increase in N_2O emissions following ploughing
- weather after incorporation wet

Heavy clay soil

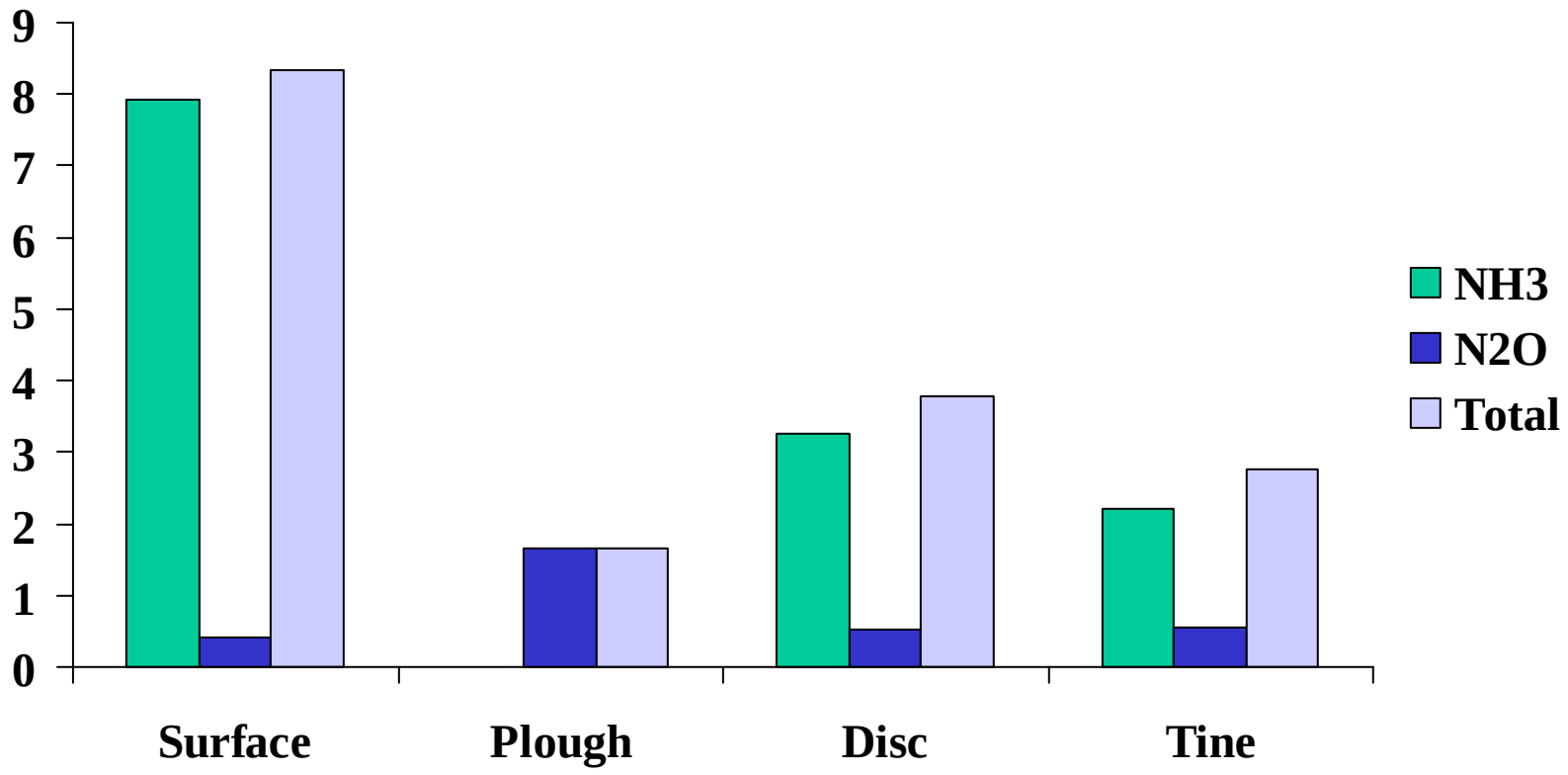


- Late summer application
- no significant effect of incorporation on N_2O
- soils dry after application

Sandy soil – costs to environment

£/ha

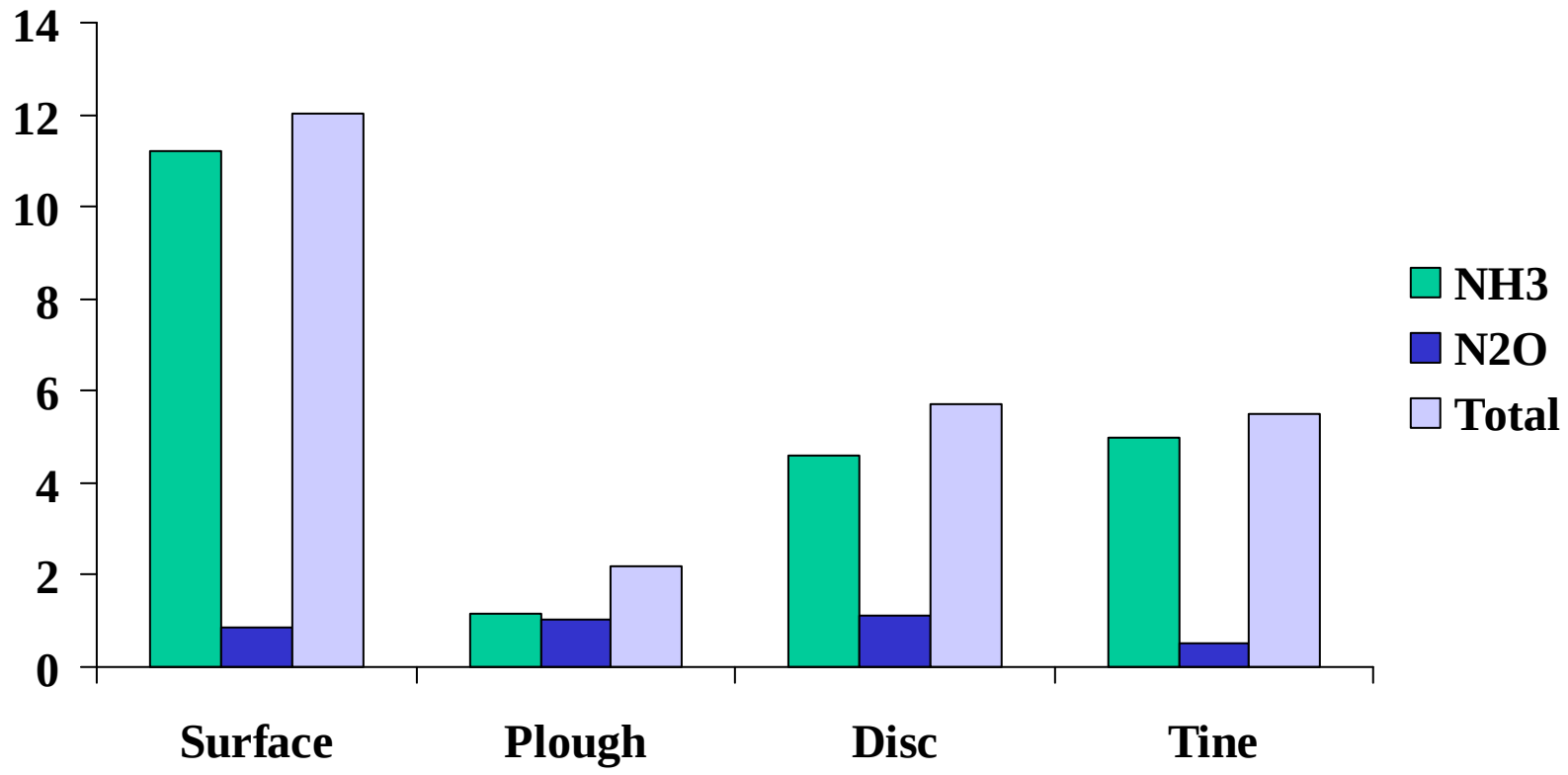
N_2O:NH_3, 5.5:1



Clay soil – costs to environment

N_2O:NH_3, 5.5:1

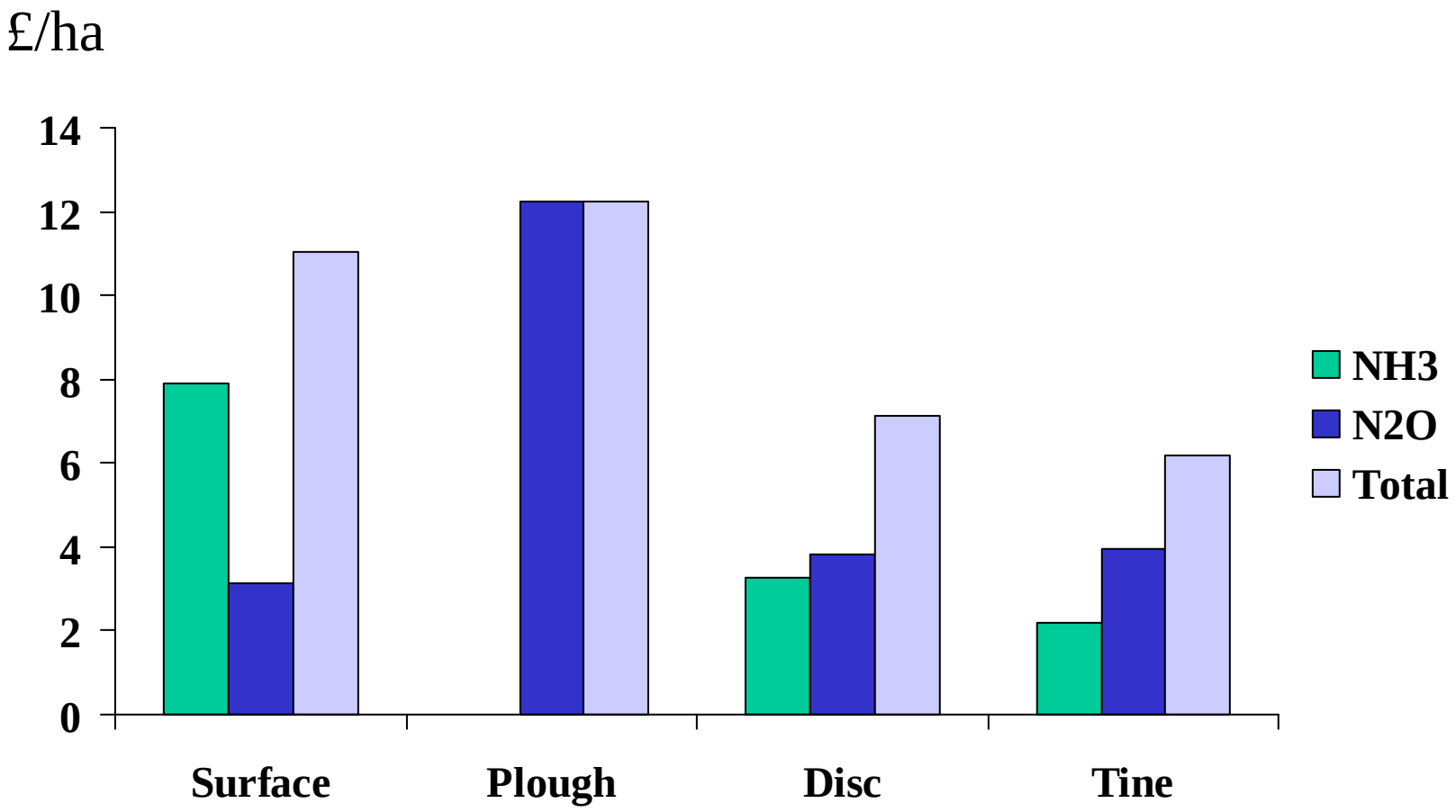
£/ha



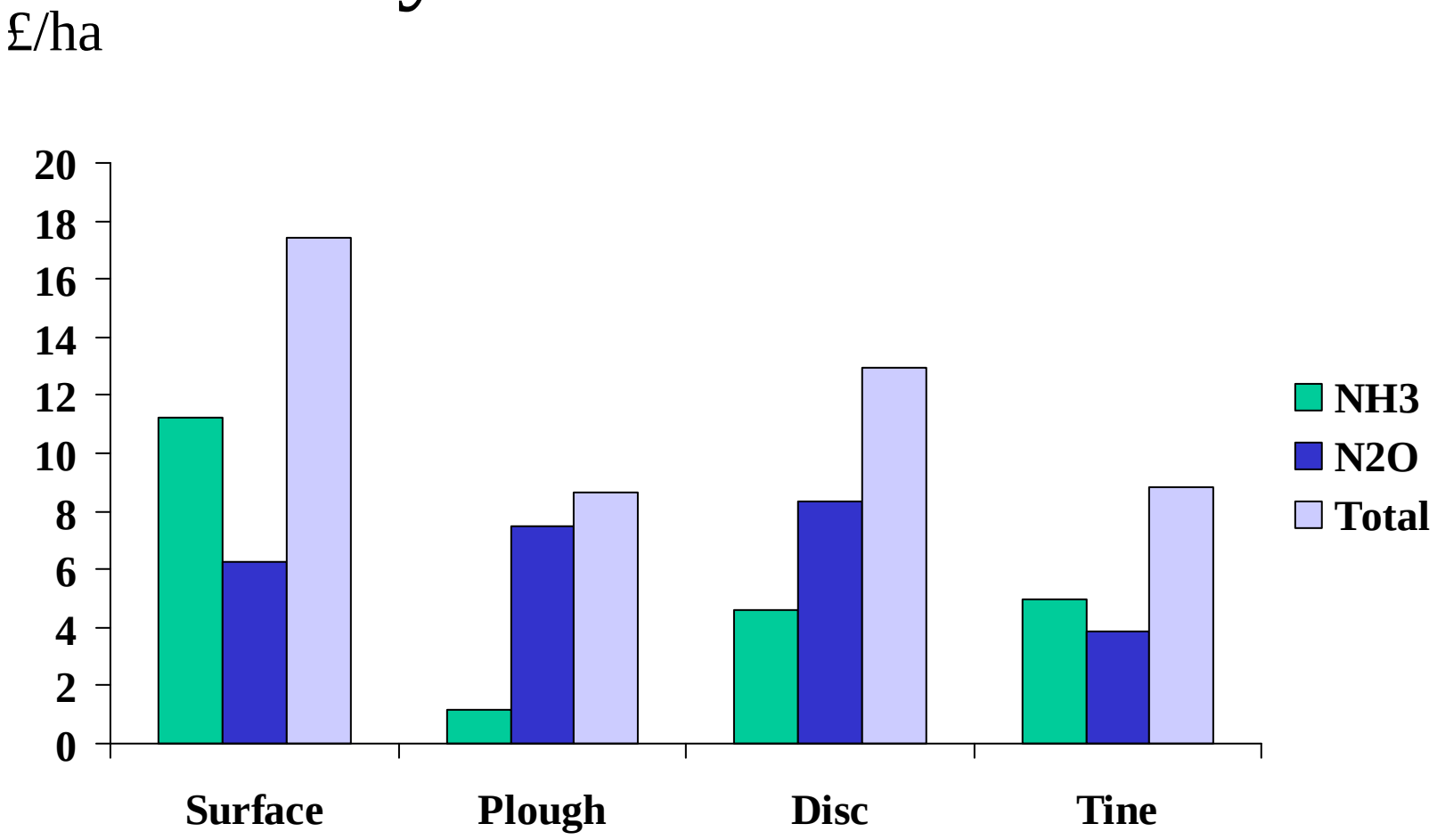
Conclusions

- N_2O measurements being made for 12 months after application
- only 3 out of 8 complete
- only 1 of 3 significant increase in N_2O
- even in that case ploughing still reduced overall cost of emissions
- Based on N_2O:NH_3 cost ratio of 5.5:1
- What if the ratio were 40:1?

Sandy soil – cost ratio 40:1



Clay soil – cost ratio 40:1



Conclusions

- Incorporation by disc still reduces total environmental costs
- and reducing NH_3 emissions will reduce indirect emissions of N_2O

Proposed manure/fertilizer strategy for an integrated N policy

- The approach should begin with reducing NH_3 emissions
  - since this loss takes place at the soil surface before the other processes begin
- this will not always increase other losses and may also reduce those of N_2O
- then address NO_3
  - many fairly simple measures can be effective
  - large losses may still lead to significant environmental cost

Proposed manure/fertilizer strategy for an integrated N policy

- Difficult to address N_2O
  - no simple measures that lead to large, consistent reductions
  - other than making large reductions in N application
  - which will often not be appropriate in light of N balance reductions
- extension of carbon trading would provide a mechanism to substantially reduce N fertilizer use
  - but this may simply displace the problem elsewhere

Conclusions - caveat

- The proposed strategy appears to ignore N_2O
- but NH_3 and NO_3 abatement does not axiomatically increase N_2O
- while reducing NO_3^- leaching reduces indirect N_2O emissions
  - albeit according to IPCC 2006 the impact is much less than formerly supposed

And finally

- Reducing emissions of NH_3 and NO_3
- will increase reliability of N supply from manures
- and give more confidence to make allowance for manure-N when estimating fertilizer requirements

Objective of talk

- To evaluate abatement of N losses with respect to the environment
- cost estimates based on those of Pretty et al
- those costs may be regarded as outdated
- but more recent cost estimates have not dealt with all N losses

Plan

- N budgets – NT1833
- Ammonia on nitrate – SUM paper
- Ammonia on N2O – Man squash
- Ammonia on N2O – Fmavis
- Conclusions

Including indirect emissions