The Signpost Series

‘Pointing the way to a low emissions agriculture’

Reducing Slurry Emissions

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Ammonia – The Challenges

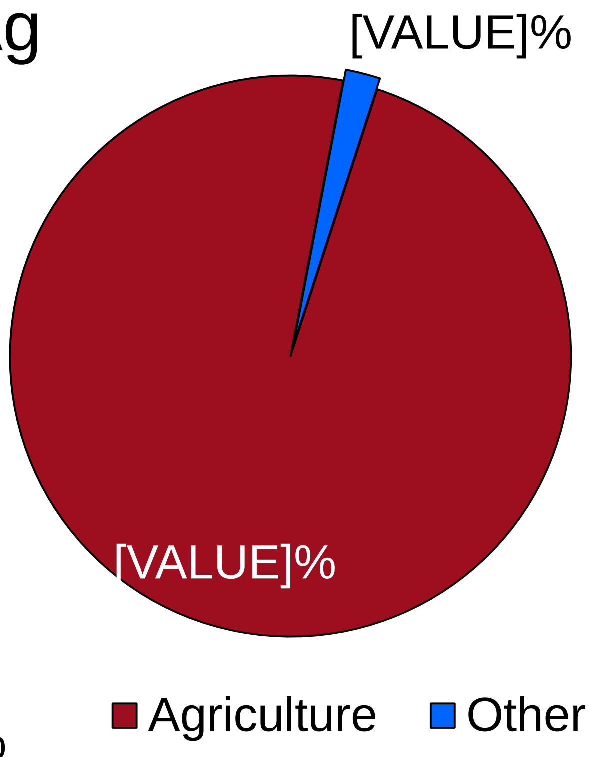
Ammonia

- 98% of ammonia emissions from Ag
    - 1% reduction to 2030
    - 5% from 2030 onwards
    - Ammonia mitigation can be synergistic or antagonistic with GHG mitigation

Ammonia Policy

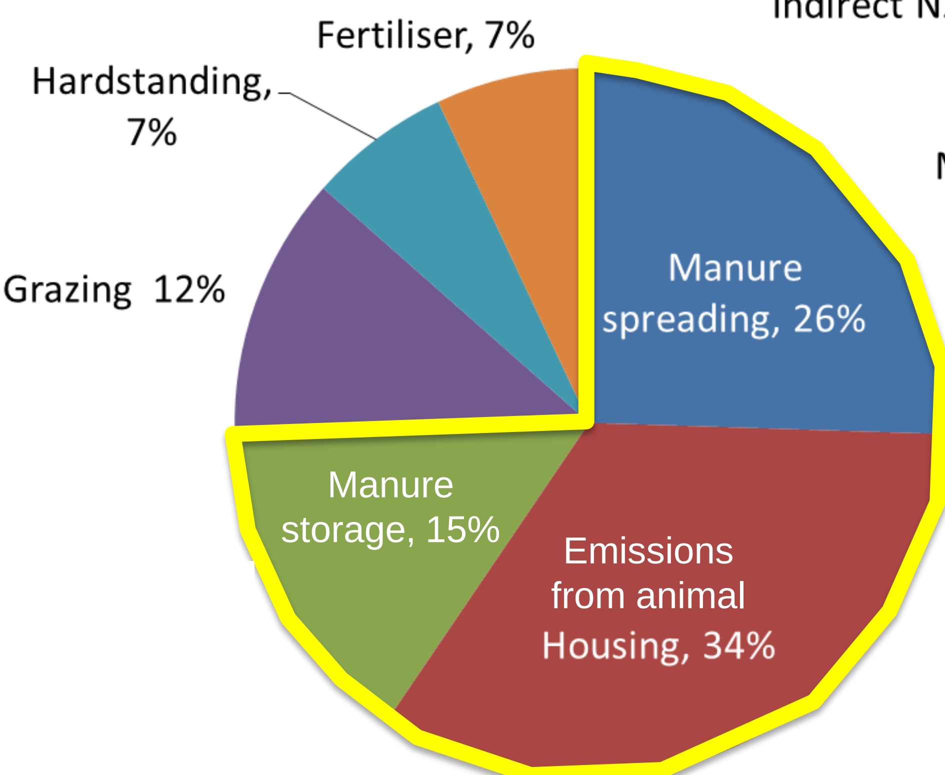
- EU Clean Air Package 2030
    - EU ammonia Ag. emissions reduction 27%
    - Ireland ammonia Ag. emissions reduction 5%

Ammonia Source

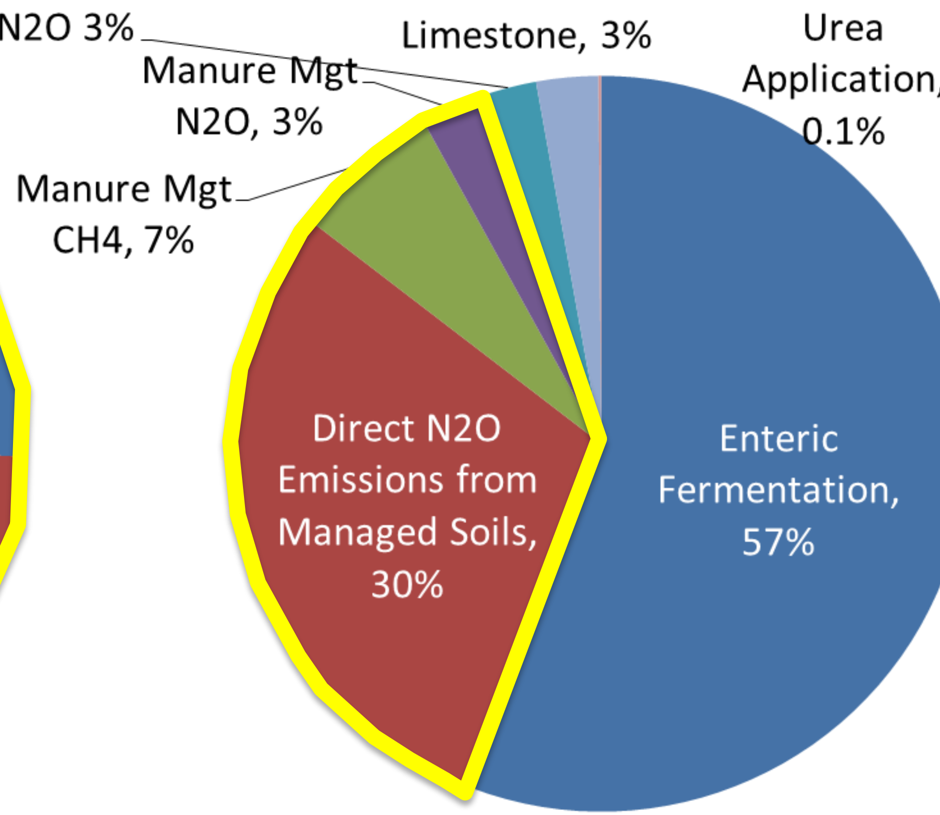


IRL Ammonia & GHG emissions profile

Ammonia



GHG



Emissions related to manure management

Areas we can identify for potential gaseous emission mitigation?

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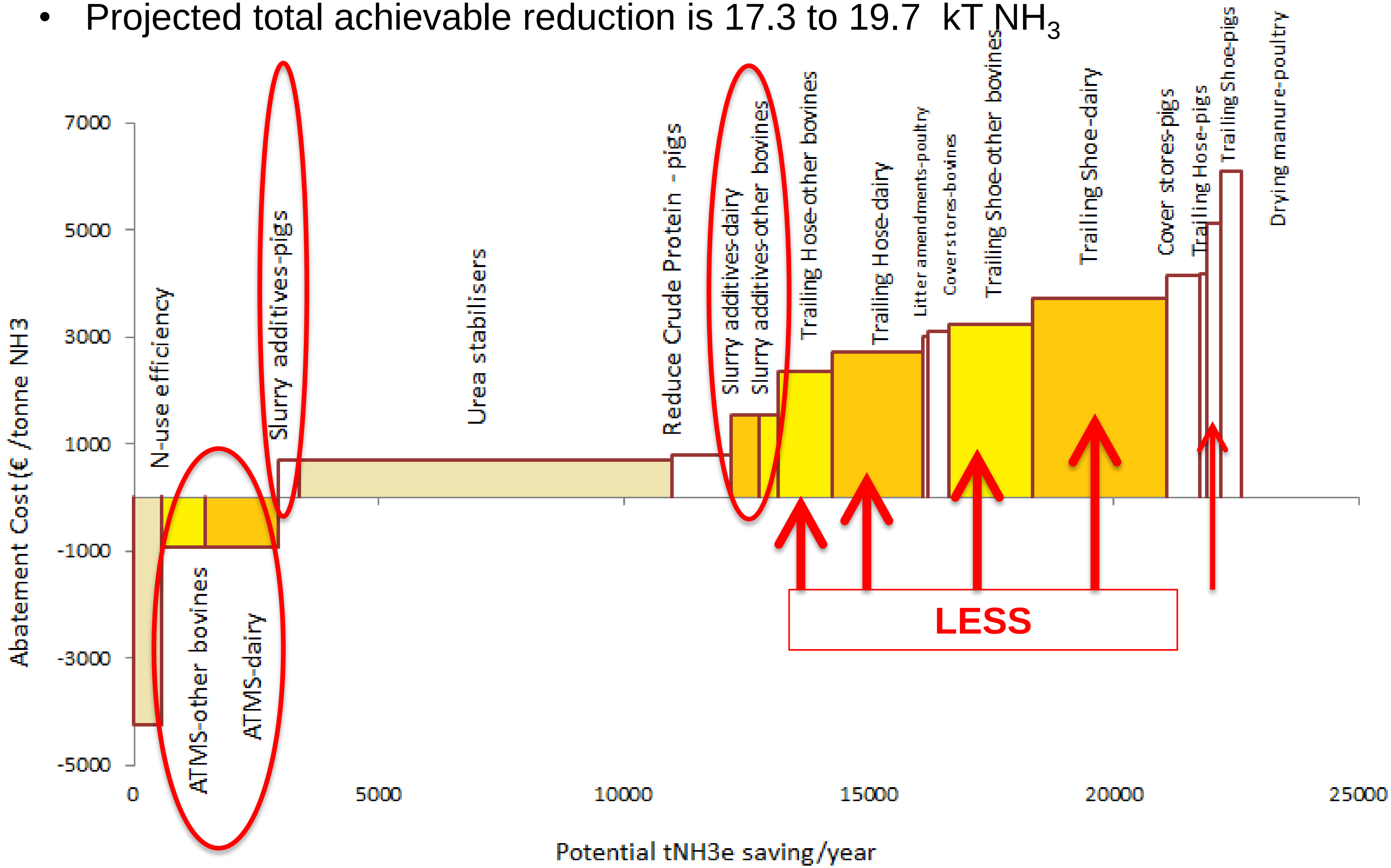
Ammonia MACC

- Projected total achievable reduction is 17.3 to 19.7 kT NH_3



Teagasc 2015, An Analysis of the Cost of the Abatement of Ammonia Emissions in Irish Agriculture to 2030

Teagasc Agriculture and Food Development Authority

Potential Management Solutions
lowering Ammonia emissions

	kT NH_3 abated
Protected urea *(switch 50% CAN to Protected Urea*)*	**7.7**
Low-emission slurry spreading (dairy slurry)	**2.7**
Low-emission slurry spreading (non-dairy slurry)	**1.7**
Alt. time manure spreading (dairy slurry)	**1.5**
Alt. time manure spreading (non-dairy slurry)	**0.91**
Reduce Crude protein pigs	**1.3**
Increase Nitrogen use-efficiency	**0.57**
Cover slurry stores pigs (& outdoor cattle slurry)	**0.68**
Slurry amendments/ additives	**0.57**

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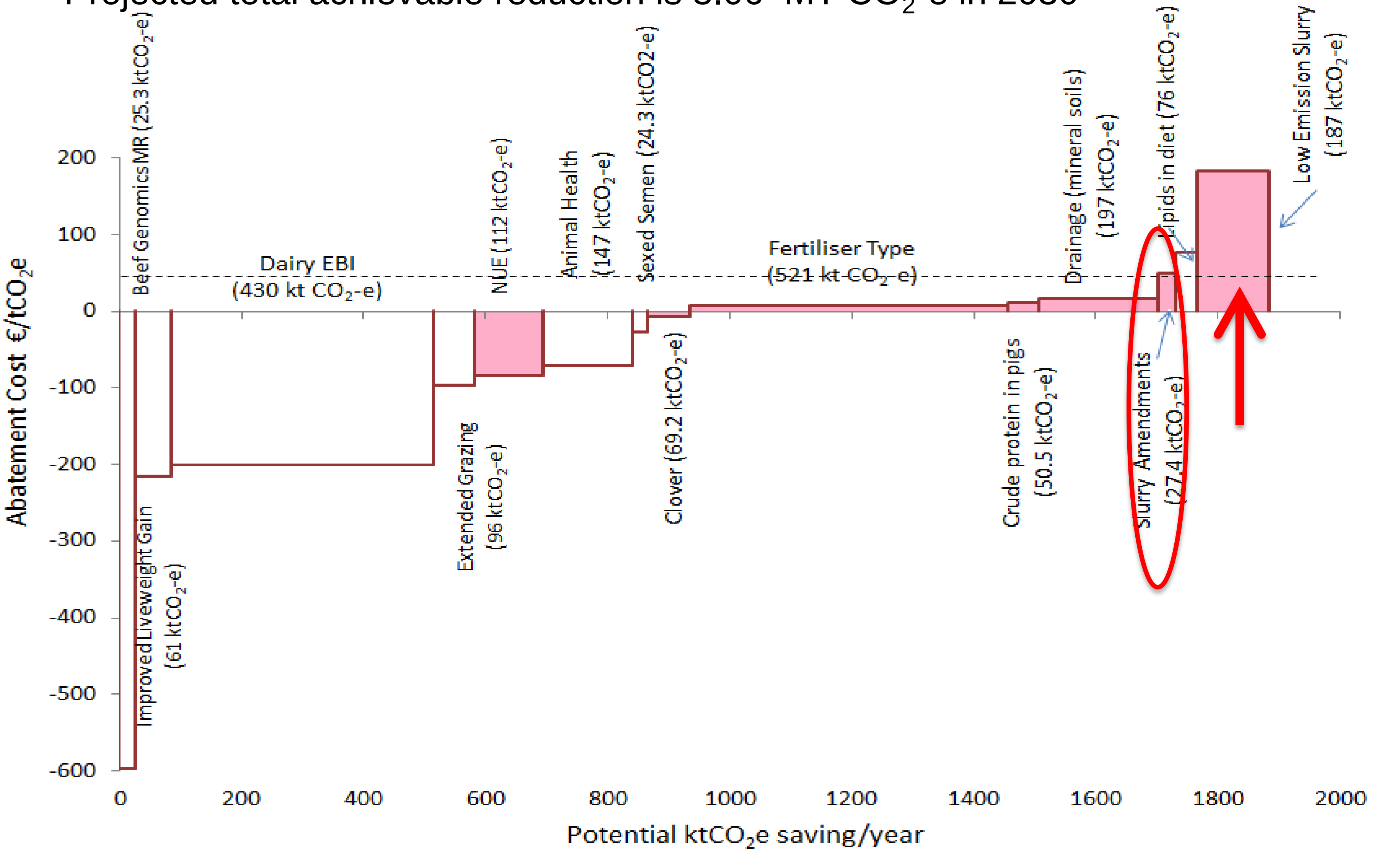
Greenhouse Gas MACC Agricultural mitigation

- Projected total achievable reduction is 3.06 MT CO_2-e in 2030



Teagasc 2018, GHG Marginal Abatement Cost Curve for agriculture for 2021-2030

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Potential Management Solutions
lowering agricultural GHG emissions

Mitigation Mt CO_2e

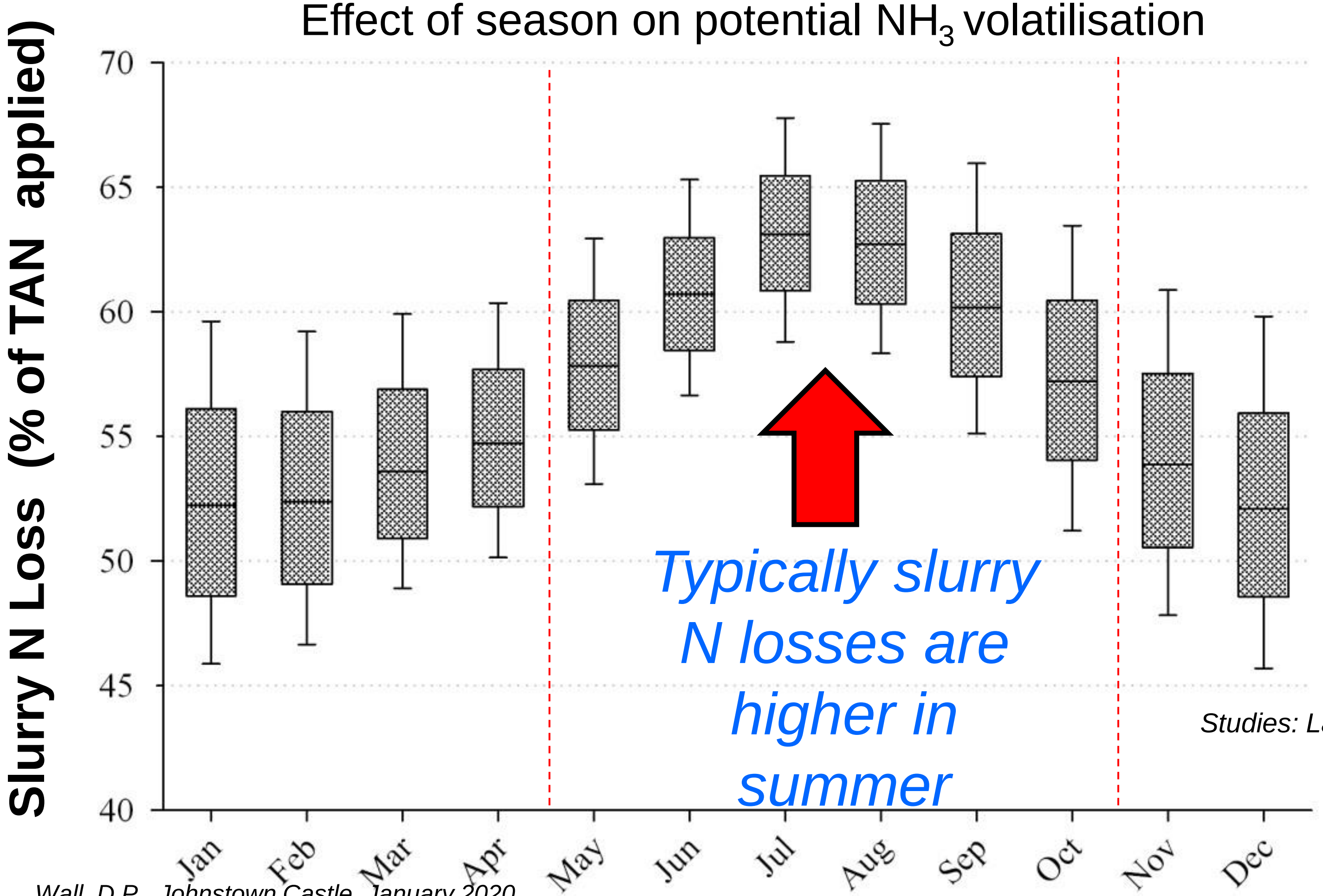
- ✓ **Soil & N management mitigation options** ~**1.2**
  - Protected urea *(switch 50% CAN to Protected Urea*)* **0.52**
  - Draining wet mineral soils *(1/3 poorly drained mineral soils)* **0.20**
  - Low-emission slurry spreading (50% slurry with LESS) **0.12**
  - Increase Nitrogen-use efficiency (Liming soils to pH 6.3) **0.10**
  - Extended grazing (20% grassland area: 250d dry & 149d wet) **0.07**
  - Inclusion of Clover (25% beef area and 15% dairy area) **0.07**
  - Slurry amendments/additives (20% slurry treated) **0.03**
- ✓ **Animal performance mitigation options** ~**0.62**

Nitrogen Loss from Slurry

Losses depend on soil and climatic conditions

- Ammonia emissions increase in dry, sunny & windy weather
- Majority of N loss occurs within 24 hours after application

Effect of season on potential NH_3 volatilisation



Studies: Lalor & Lanigan (2010)

Søgaard et al. (2002)

Wall, D.P., Johnstown Castle, January 2020

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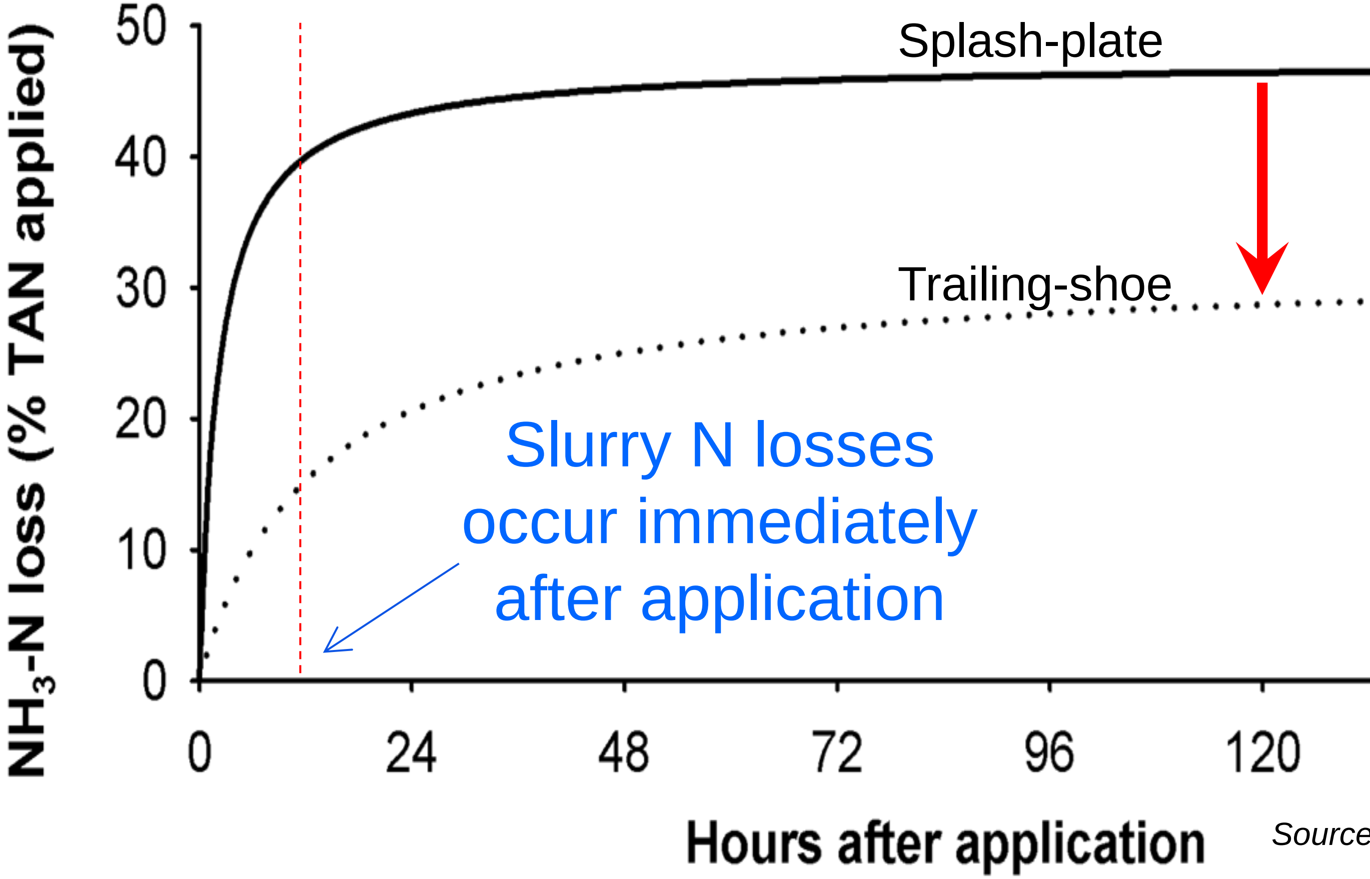
Reducing Ammonia Loss – LESS?

Slurry Application method



Source: Dowling et al. 2010

In this example: Trailing-shoe reduced emissions by 36% compared to Splash-plate

Total ammonia emission reductions of up to 65% found with other studies

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Nitrogen Fertiliser Replacement Values

Application Method	**Splash Plate** / Broadcast	**Dribble bar** /Bandspreader	**Trailing Shoe**	**Shallow Injection**
				
NH_3 Abatement[1]	0%	30%	60%	70%
Total slurry N % availability[2]	27%	35%	43%	46%
Available N from 11m^3 Cattle slurry[3]	7 kg N	9 kg N	11 kg N	12 kg N
Value Nitrogen €[4]	€6.00	€7.70	€9.40	€10.20

1, Ammonia loss abatement potential of different LESS methods as per ammonia gas inventory (EPA)

2, Total slurry N availability for different slurry spreading methods, based on ammonia loss abatement.

3, Available N in 11m^3 (1000 gallons) cattle slurry using different spreading methods. Typical total N in cattle slurry is 2.4 kg N/m^3, as per Teagasc Green Book (Wall and Plunkett 2016)

4, Economic value (€) of N in 11m^3 slurry based on protected urea price of €0.85/kg N

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Synergies & antagonisms

Ammonia vs. GHG's

- Reducing ammonia emissions
  - reduce **INDIRECT** N_2O *(GHG)* emissions.
- Altered timing & technique for land-spreading of manures
  - can increase **DIRECT** N_2O emissions
- LESS and SPRING spreading of manures
  - will reduce Ammonia and also total N_2O emissions
- Reducing CP% in diet will reduce both N_2O & Ammonia
  - limited application where animals are at pasture
- Slurry amendments added during manure storage
  - reduce both methane *(GHG)* & ammonia from slurry storage