The Signpost Series

‘Pointing the way to a low emissions agriculture’

Reducing Slurry Emissions

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Ammonia – The Challenges

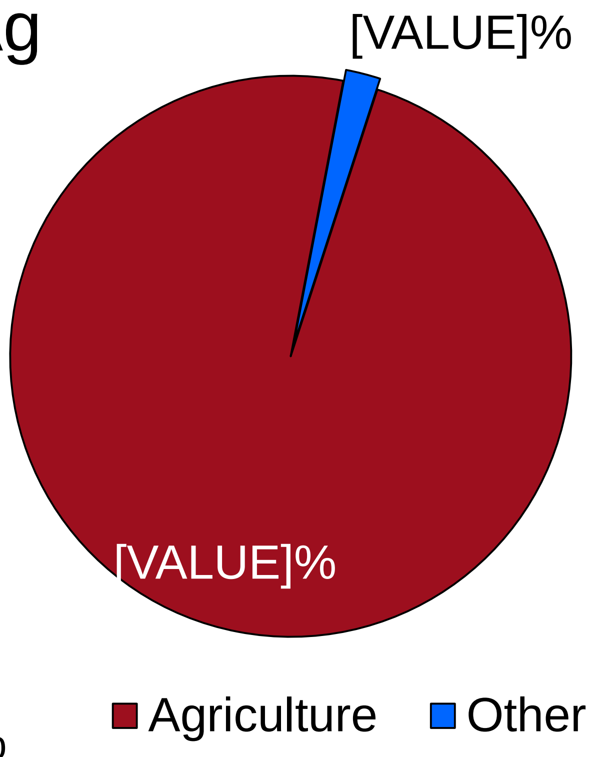
Ammonia

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

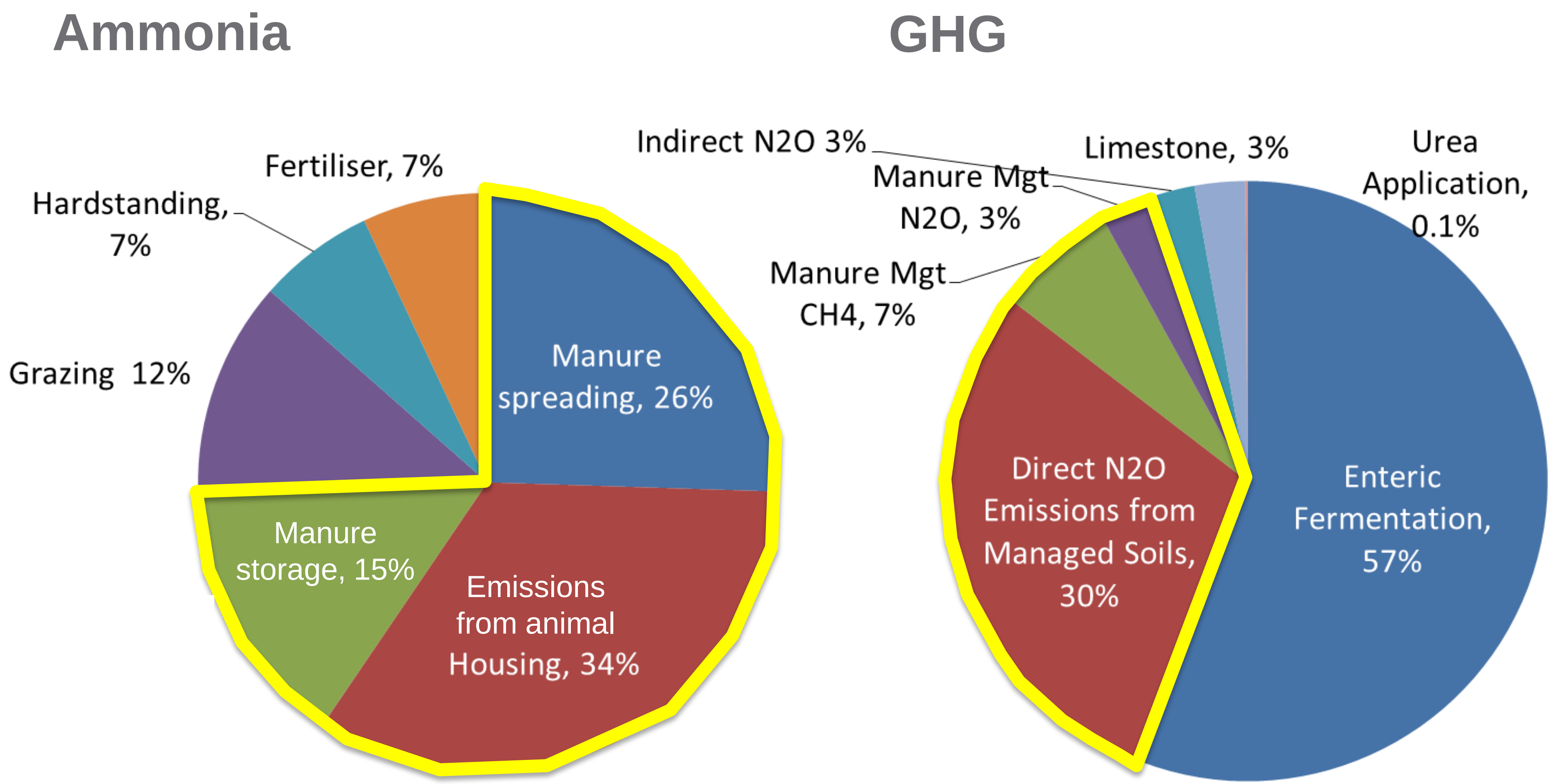
Ammonia Policy

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

Ammonia Source



IRL Ammonia & GHG emissions profile

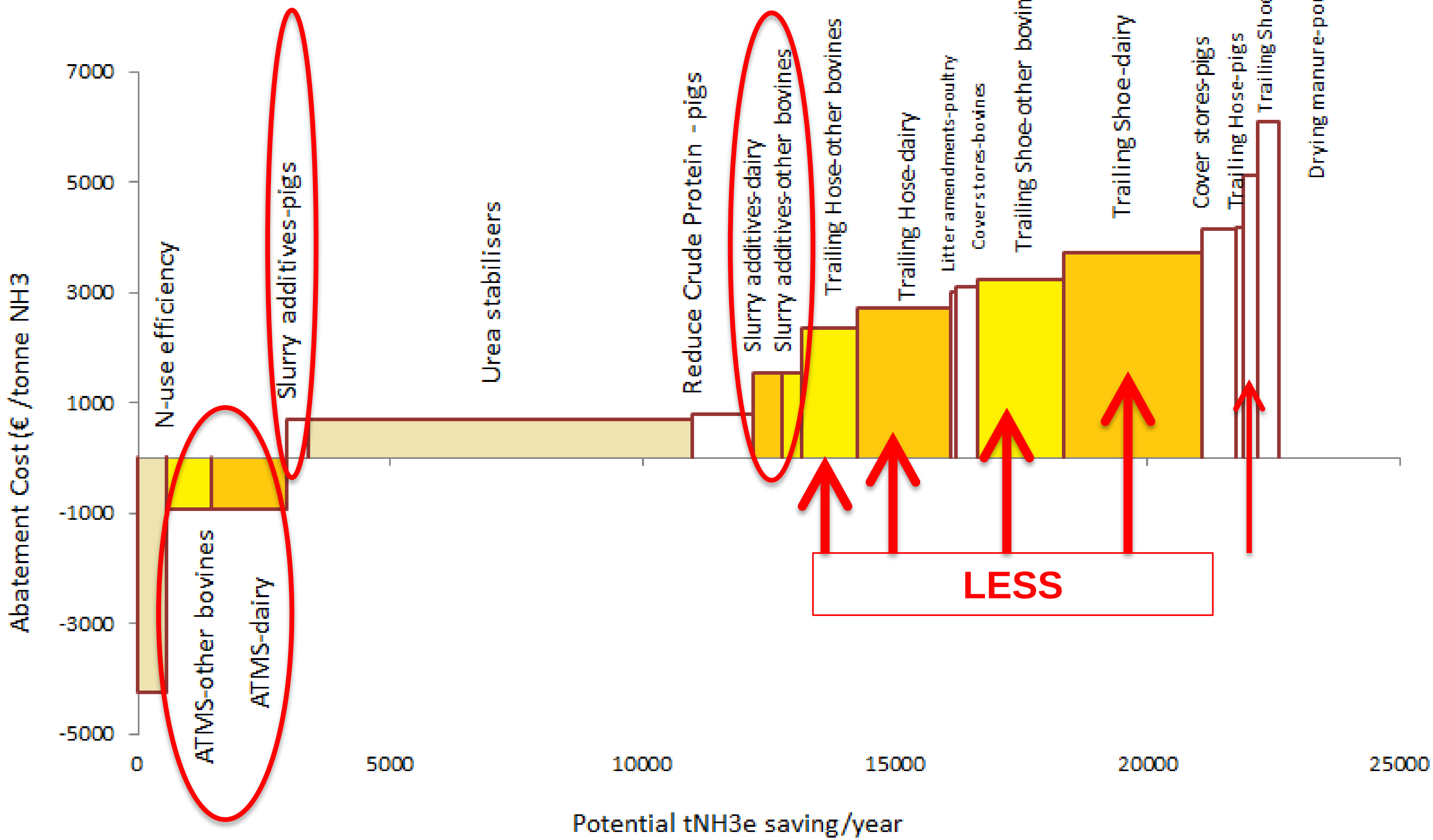


Emissions related to manure management

Areas we can identify for potential gaseous emission mitigation?

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

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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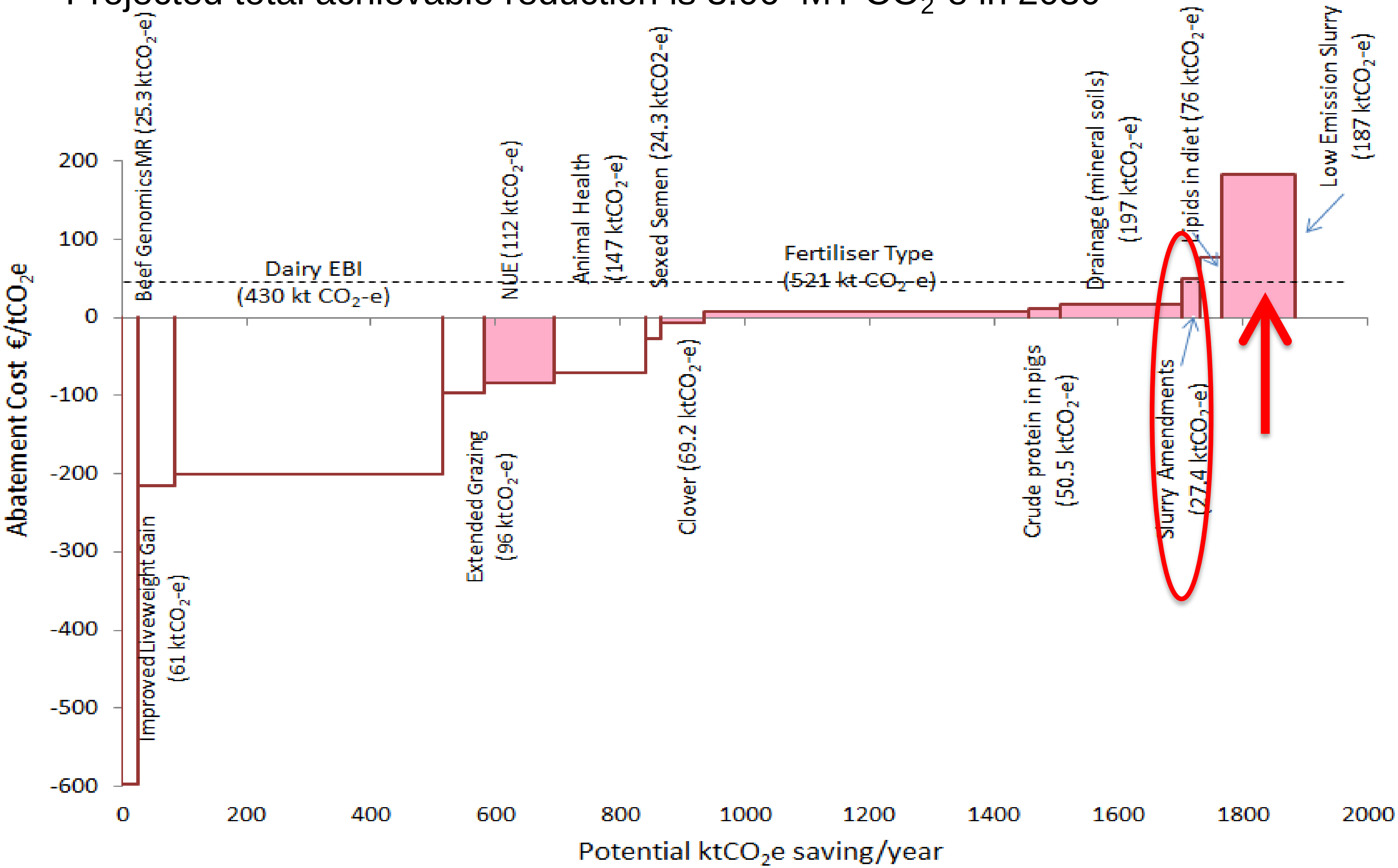
Greenhouse Gas MACC Agricultural mitigation

- 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

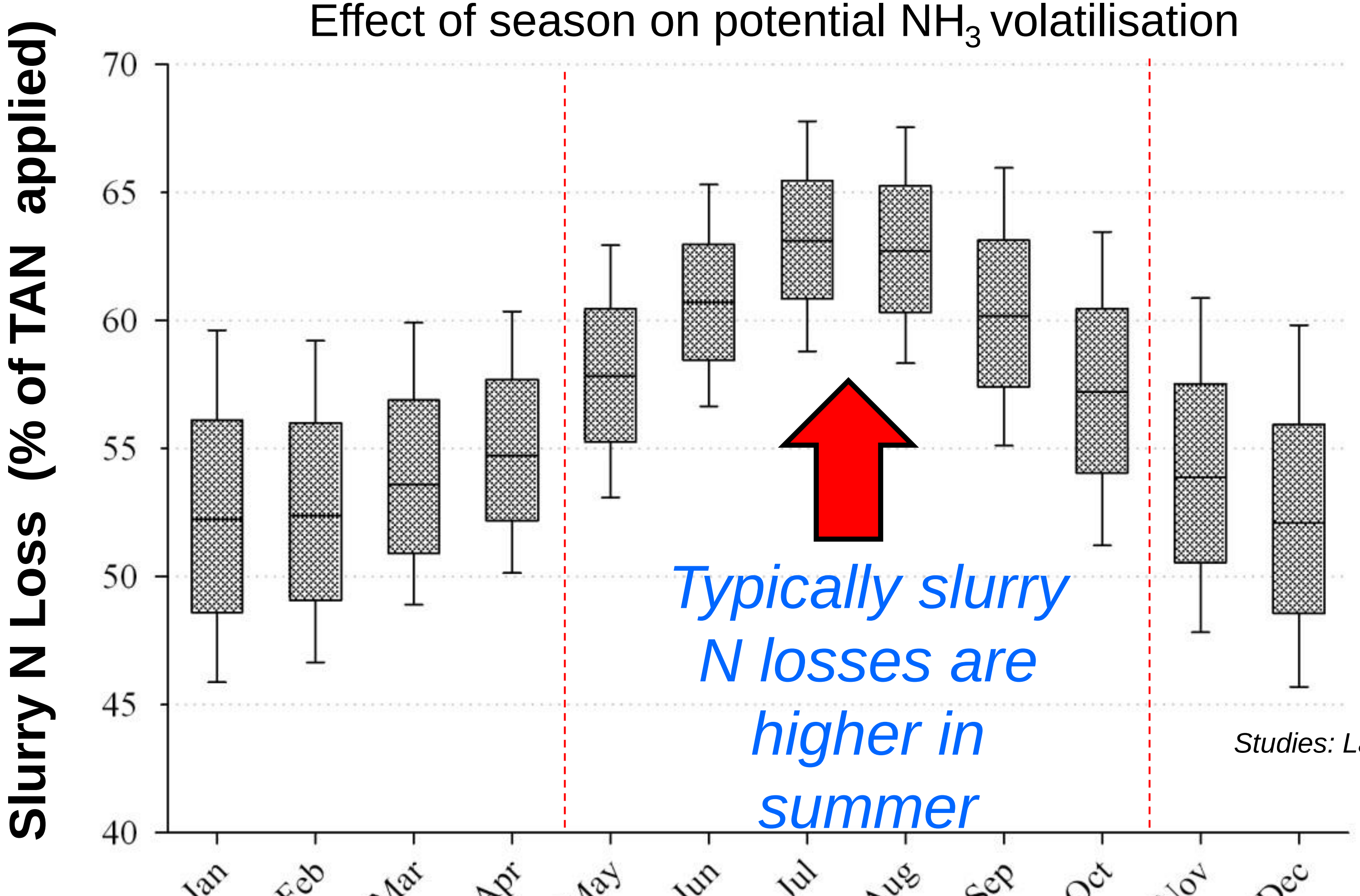
	Mitigation Mt CO_2e
✓ **Soil & N management mitigation options**	~**1.2**
▪ Protected urea *(switch 50% CAN to Protected Urea*)*	**0.52**
▪ Draining wet mineral soils *(1/3 poorly drained mineral soils)*	**0.20**
▪ Low-emission slurry spreading (50% slurry with LESS)	**0.12**
▪ Increase Nitrogen-use 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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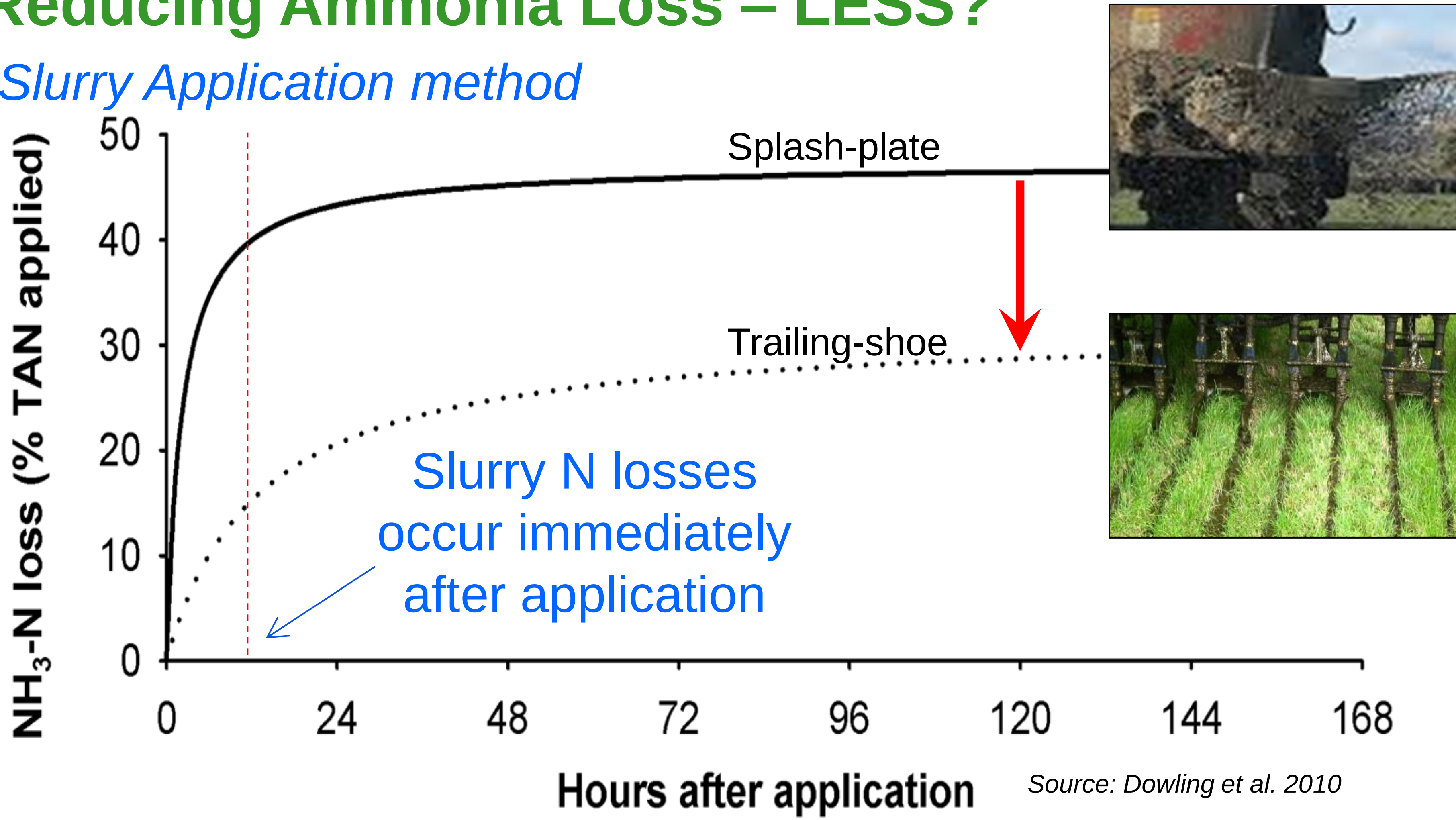
Reducing Ammonia Loss – LESS?

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

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