KPMG Sustainable Futures

DEVENISH Beyond Nutrition

Meeting our sustainability targets in agriculture; The Agri biomethane opportunity.

March 2022

A study commissioned by Gas Networks Ireland.

Gas Networks Ireland

Introduction

Background and context

- Although AD is considered a proven technology, there have been a number of environmental and economic concerns cited which have hampered its development in Ireland.

Project aims

- To provide scientific analysis and real-world data on the key questions and knowledge gaps concerning the sustainability of an Irish biomethane industry developed through a network of agri-led AD plants.

Project outcomes

- Evidence that the development of a sustainable biomethane industry in Ireland is technically feasible.
- However, if not developed in a coordinated manner there is a risk that an indigenous biomethane industry could result in unintended negative consequences.

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Alignment with policy

There is growing pressure on industry to decarbonise and biomethane represents a key opportunity to achieve this

- EU climate policy and Ireland's Climate Action and Low Carbon Development (Amendment) Bill 2021 both demonstrate that the **direction of policy travel is towards net zero emissions by 2050.**
- Regulations are putting increasing pressure on the sector to improve its broader sustainability performance.
- AD biomethane can aid in industry decarbonisation in addition to wider environmental benefits.

Alignment to the EU Farm to Fork goals
Ensure food production has a **neutral or positive environmental impact**
EU Carbon Farming Initiative
Promote a **circular bio-based economy**
50% reduction in nutrient losses without reducing soil fertility
Increase the proportion of **organic farming** to 25% by 2030
Implement a **sustainable food labelling framework**

Alignment to the EU Biodiversity Strategy for 2030
At least 10% of agricultural area is under high-diversity landscape features
At least **25% of agricultural land** is under organic farming management

Alignment to the Programme for Government goals
Seek reforms to CAP to reward farmers for **sequestering carbon**
Continue to support farmers to embrace farming practices that are **beneficial environmentally**, have a lower carbon footprint and better utilise and protect natural resources
Encourage investment in **renewable infrastructure** on farms
Explore opportunities for farmers from **anaerobic digestion**
Deliver an incremental and ambitious reduction in the use of **inorganic nitrogen fertiliser** through to 2030

Alignment to Ag-Climatise
Action 1 reduce chemical nitrogen use to 325,000 tns by 2030
Action 9 - Increase organic production to 350,000 ha by 2030
Action 12 – promote a sustainable bio-economy in agri-food
Action 17: Develop a pilot scheme in relation to on-farm carbon trading
Action 20: : Engage with stakeholders to maximise the potential opportunities from Anaerobic Digestion for the agriculture sector

Fully aligned **Partially aligned**

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Soil fertility in Ireland

Dairy

21% of soils have optimum pH, Phosphorus and potassium
59% of soils with a soil pH of greater than 6.2
48% of soils at index 1 and 2 for phosphorus
41% of soils at index 1 and 2 for potassium

Beef

18% of soils have optimum pH, Phosphorus and potassium
56% of soils with a soil pH of greater than 6.2
55% of soils at index 1 and 2 for phosphorus
43% of soils at index 1 and 2 for potassium

Teagasc, soil atlas (2020)

Land availability and incremental feedstock for AD

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Land availability

- To determine the potential area of land available for AD in Ireland, this project:
  - Excluded areas of High Nature Value land, commonage and rough grazing
  - Excluded land used by the dairy industry
  - Excluded smaller land parcels

Feedstock availability

- This target land produces an average of 6t DM/ha, and based on research by Teagasc and Dowth, we have assumed this can be increased to 10t DM/ha.
- Based on these assumptions we have calculated that Ireland has the ability to produce an incremental **3.1mt DM/ha per annum** outlined below:

		Total
Total grassland	Mha	4.5
Available grassland	Mha	1.1
Suitable land	Kha	768
Realisable production	Mt DM	3.1
Realisable production	TWh	9.5

NI case study

- **NI deployed c.90 AD plants** between 2011 and 2017 - the majority agricultural AD plants fed on silage and slurry.
- Despite these plants consuming an incremental c.700,000 tns of grass silage annually:
  - **Number of dairy cattle grew** by c.12%, and overall cattle numbers increased by 4%.
  - **Farmland dedicated to grass increased** by over 25,000 ha, including an 18% increase in land with grass less than 5 years old - suggesting a material programme of reseeding and land optimisation, in line with anecdotal evidence of AD plant owners achieving increased grass yields from improvement management.
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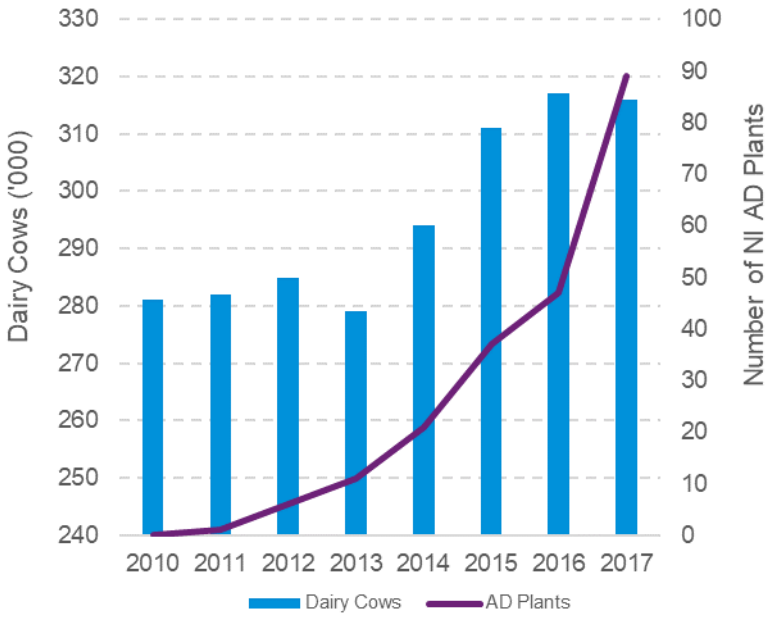

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Carbon balance

- The Dowth Multispecies Swards Model captures emissions from livestock, animal manure storage and application, fertiliser use and carbon from electricity and diesel on farm as well as carbon sequestration for a 32 ha farm with c.30 beef cattle.

MSS with cattle

For the whole farm	Baseline year	Year 1	Year 2	Year 3	Year 4	Year 5
Total Grass DM utilised	194	312	349	351	355	360
Carbon footprint tnsCO_2e	122	98	112	100	111	111
Carbon offset tnsCO_2e	42	56	62	69	75	81
Net carbon footprint tnsCO_2e	80	42	50	31	36	30

MSS with no cattle

For the whole farm	Baseline year	Year 1	Year 2	Year 3	Year 4	Year 5
Total Grass DM utilised	194	337	340	343	343	346
Carbon footprint tnsCO_2e	51	17	8	18	9	12
Carbon offset tnsCO_2ee	42	56	62	69	75	81
Net carbon footprint tnsCO_2e	9	-39	-54	-51	-66	-69

Land availability and incremental feedstock for AD

- In the short term, more fertiliser and lime inputs are needed to build soil fertility - **as just 21% of agricultural soils are at optimal fertility**, leaving a nutrition gap that must be filled to get to an optimum level (target index 3).
- Once soils have reached optimum fertility, only maintenance fertiliser will be required and forage yields will have stabilised at higher productivity rates - **c.11.21 tnDM/ ha compared to the national average of 6 tnDM/ha.**

MSS sward, exclusively forage for AD

- The adoption of MSS allows all nitrogen input to be supplied by digestate. Soil phosphorus and potassium levels need be supplemented to build soil nutrition.
- 100% of nitrogen requirement is supplied through slurry digestate.
- 49% of phosphorus requirement is supplied through digestate.
- 22% of potassium requitement is supplied through digestate.
- The reduction in artificial nitrogen and enteric emissions from cattle reduce GHG emissions by 69%.
- Our partial LCA shows an increased forage yield from 6 tnDM/ha to an average of 11.21 tnDM/ha with the adoption of MSS.

MSS sward, grazing cattle and forage for AD

- The adoption of MSS allows 69% nitrogen input to be supplied by digestate. Soil phosphorus and potassium levels need be supplemented to build soil nutrition.
- 69% of nitrogen requirement is supplied through digestate.
- 42% of phosphorus requirement is supplied through digestate.
- 28% of potassium requitement is supplied through slurry and digestate.
- Our partial LCA shows an increased forage yield from 6 tnDM/ha to an average of 11.21 tnDM/ha with the adoption of MSS.

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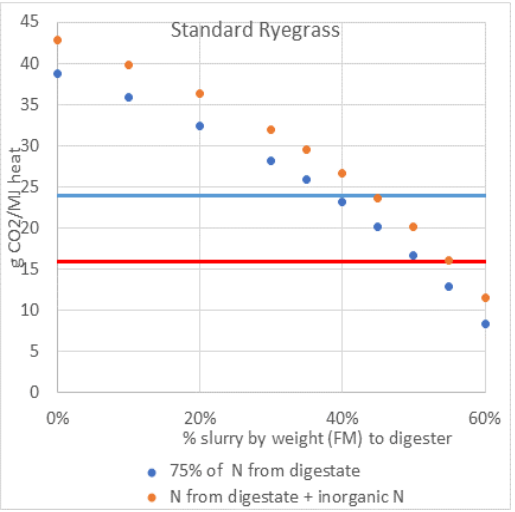
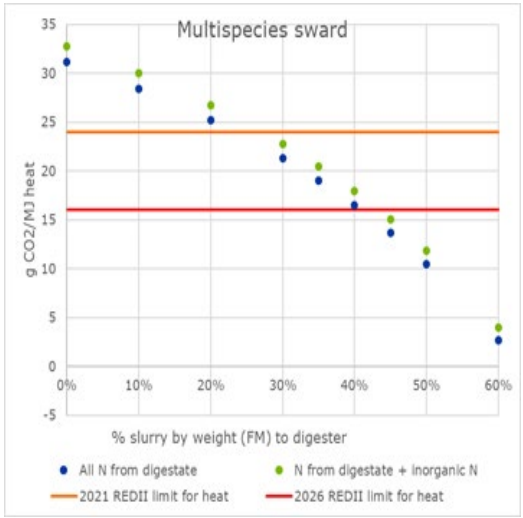
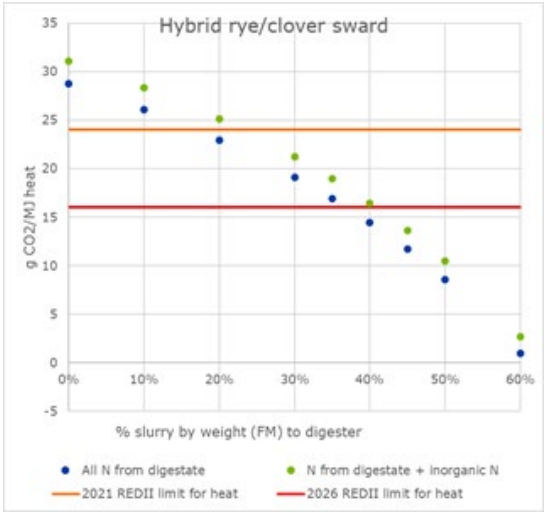
Ability to meet RED II sustainability criteria







- SEAI, Ricardo Energy & Environment and Teagasc
- Depending on the sward type, between c.40-55% slurry inclusion required to meet 2026 80% reduction in GHG emissions

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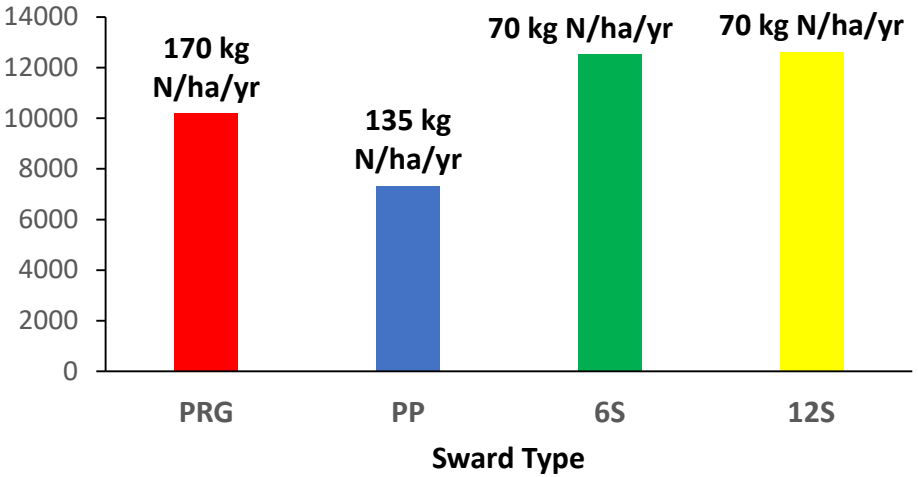
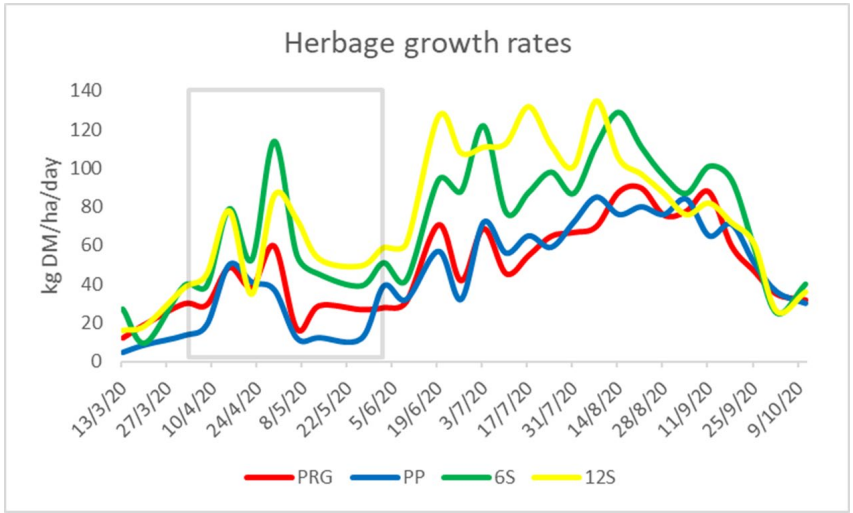
Resilience

On-farm resilience

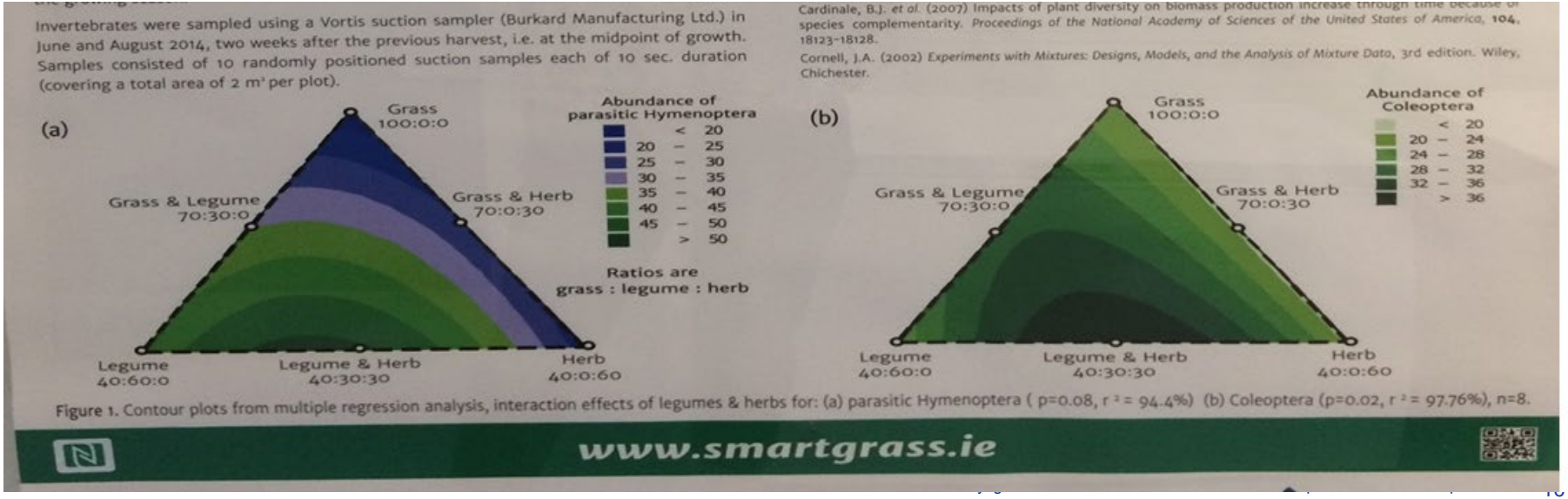
- Research from Dowth demonstrated that during drought periods MSS outperformed PP and PRG.
- The below figure summarises the potential of MSS to offer on-farm resilience to drought periods





Biodiversity

- Evidence suggests that plant richness is positively corelated to biodiversity.
- The implementation of MSS (containing up to 12 sward types) as a feedstock for AD may enhance biodiversity.
  - The study demonstrated a **300% increase in earthworm** abundance under the MSS swards compared to the PRG swards, thus indicating that MSS can enhance soil health and biodiversity.



Schmidt et al, (2016)

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Soil quality and carbon sequestration

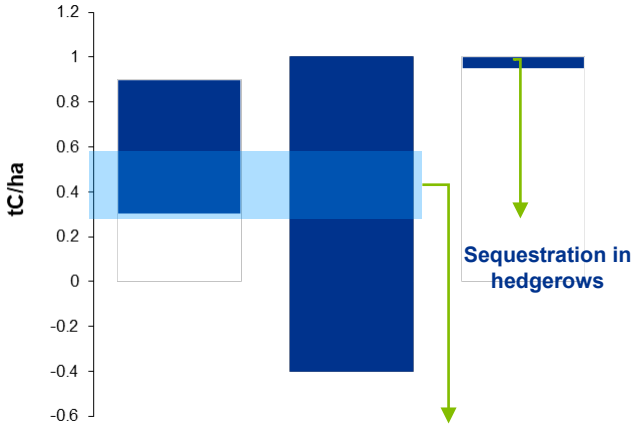
Soil nutrition and quality is a critical component of the partial LCA completed for this report. Optimal soil fertility can reduce emissions, increase yields and reduce nitrogen fertiliser use. For soil carbon sequestration, improved soil pH and nutrition can increase soil's ability to sequester carbon.

Soil quality

- Soil health is a fundamental requirement for achieving optimal yields and ensuring continued, sustainable production
- This report includes an overview of the **Devenish Soil Improvement Programme** which helps farmers to optimise soil health, nutrition and minimise soil compaction
- Devenish Soil Improvement Programme consists of three pillars:
  - Physical Structure
  - Chemical Analyses
  - Biological Composition
- The Soil Improvement Programme is proven to help maintain grass yields while reducing the nitrogen inputs and increasing the quality of nutrition from grass.

Carbon sequestration

- Soil carbon sequestration is driven mainly by **soil type, management and climate**
- The below figure provides an overview of estimates for soil carbon sequestration rates



Report assumes carbon sequestration 0.3 - 0.5 tC/ha

(Fornara et al., (2016)

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Concept of an AD Charter

To ensure the successful roll-out of an agri-based biomethane industry, and protect against unintended consequences, we suggest the development of an AD Charter which would apply to all biomethane projects developed in Ireland

- The aim of the Charter would be to outline the key requirements that participants should adhere to.
- The Charter could be developed to cover plant developers and owners, feedstock suppliers, plant operators and farmers acting as off-takers for digestate.
- While the Charter would need to be fully developed in consultation with industry stakeholders, we have outlined below a potential approach:

Tier 1 – Compulsory compliance				Tier 2 – Optional best practice			
Sustainability criteria				Improved land management programme		Advanced measurement, reporting and verification	
RED II alignment	NAP compliance	CAP SMR GAEC alignment	EU Farm to Fork goal - Reduced nutrient loss	Advanced EU Farm to Fork goals	Soil improvement programme	Biodiversity richness	Soil carbon

- Implement new green business models that sequester carbon
- Promote a circular bio-based economy
- Reduce pesticide use and excess nutrients
- Reduce fertiliser use
- Increase organic farming

- To optimise soil health, nutrition and minimise soil compaction

Thank you

Read the report:

·https://www.gasnetworks.ie/biomethane-sustainability-report-2021.pdf

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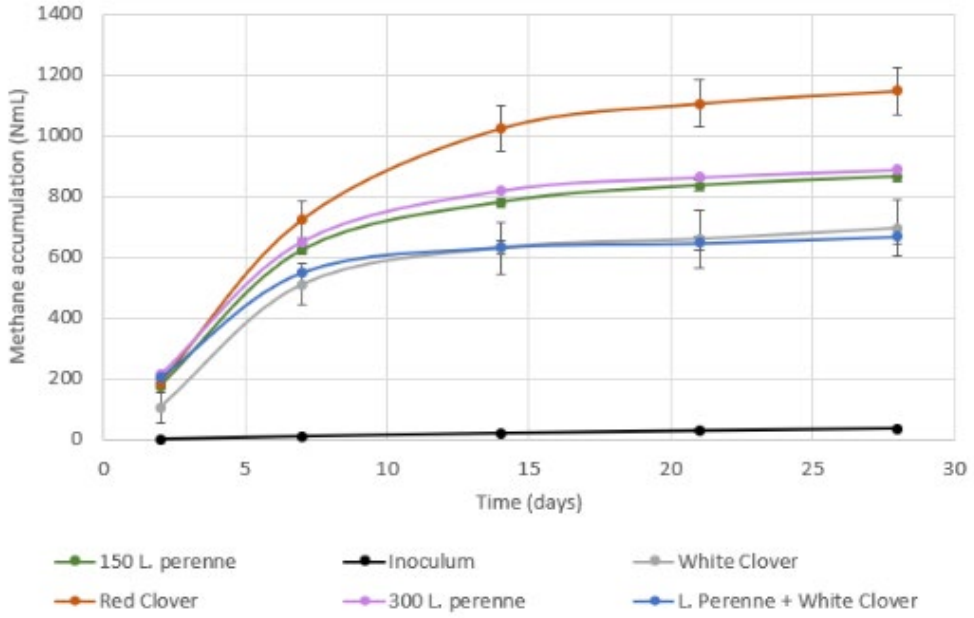
Biological methane potential multispecies swards



Personal comm. Vincent O'Flaherty NUIG