Farming Futures R&D Fund: Low Emissions Farming

Competition Q&A and Consortium Building Event

8th May 2025 10am - 12pm

UKRI Innovate UK

Farming Futures R&D - Low Emissions Farming funding opportunity

Apply now: https://bit.ly/Farming-Futures

Department for Environment Food & Rural Affairs

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Scan the QR code and apply now

Agenda 8th May

1 **Welcome**

10:00 -10:05 Caroline Griffin Innovate UK Business Connect

2 **Farming Innovation Programme Overview**

10:05 -10:10 Alex Howell, Defra

3 **Competition Overview**

10:10 - 10:20 Chris Danks, Innovate UK

4 **Q&A Session**

10:20 – 10:35 Questions for Chris and Alex

5 **Project experiences from NIAB**

10.35 –10.45 Lydia Smith, NIAB

6 **LCA in the Agricultural Industry**

10:45 –10:55 John Henry Looney, UK Agritech Centre

7 **Comfort Break**

10:55 – 11:10

8 **Breakout Rooms**

11:10 –12.00 Themed and Random

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Housekeeping

- Please stay on mute **throughout the talks**. 
- Please put any **questions in the chat box** and also use the chat function to network.
- During the **breakout room session turn your camera and microphone on**. 
- **Slides will be shared with all registrants** by email incl. recording of presentations (breakout rooms will NOT be recorded).
- Remember to **share details/copy what you need from the chat.**

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About us

Innovate UK Business Connect exists to link innovators with new partners and new opportunities beyond their existing thinking.

Accelerating ambitious ideas into real-world solutions.

UKRI Innovate UK

Deep expertise in AgriFood

Livestock & Aquaculture

Crops

Food

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How we can help

Make powerful connections

Secure funding

Get expert insight

Keep up to date

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Farming Futures R&D Fund: low emissions farming

Alex Howell
Policy Advisor at Department for Environment, Food and Rural Affairs

Department for Environment Food & Rural Affairs

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Farming Innovation Programme

Enhancing productivity, environmental sustainability and resilience in England's farming sectors

Why are we supporting innovation?

Productivity: The UK has seen lower productivity growth than our neighbours over the last 30 years

Environment: Agriculture accounted for 10% of UK greenhouse gas emissions in 2018

Fragmentation: many fantastic researchers, innovative businesses and promising ideas, but players don't necessarily collaborate effectively

Coordination: failures in the current innovation system result in poor translation of public spending into real life impacts on productivity/sustainability

Adoption: Low levels of uptake of innovation by farmers, growers, businesses in large part due to capital risk & ineffective knowledge sharing

Previous Programmes

2013 - Agri-Tech Strategy
£70m Agri-tech Catalyst
£90m for 4 Agri-tech Centres

2018 - Industrial Strategy Challenge Fund (ISCF) £90m Transforming Food Production Challenge.

2021 - £14.5m **Farming Innovation Pathways** fund.

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https://farminginnovation.ukri.org/

The Farming Innovation Programme

- Part of Defra's Agricultural Transition Plan
- To enhance productivity, environmental sustainability and resilience in England's farming sectors
- Funding is awarded on a competitive basis to high quality, innovative projects
- Collaborative projects must benefit farmers and growers in England

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The **Farming Innovation Programme** offers a range of opportunities for farmers, growers, businesses and researchers to collaborate on industry-led research and development:

Small **Research Starter Projects** where farmers, growers & foresters can explore a new idea

Feasibility projects where businesses can check if a research idea works in practice.

Small/Large Partnership Projects, where businesses can further develop a new farming product or service towards commercialisation.

Themed competitions (Farming Futures R&D Fund), where businesses and researchers can work on longer-term innovation focussing on issues like: Climate-Smart Farming, Sustainable farm-based Proteins, Robotics and Automation, Environmental resilience or Nutrient Management

ADOPT Fund where farmers can trial on-farm new innovations, practices or technologies

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https://farminginnovation.ukri.org/

Farming Futures R&D Fund: low emissions farming

Chris Danks
Interim Head of AgriFood at Innovate UK

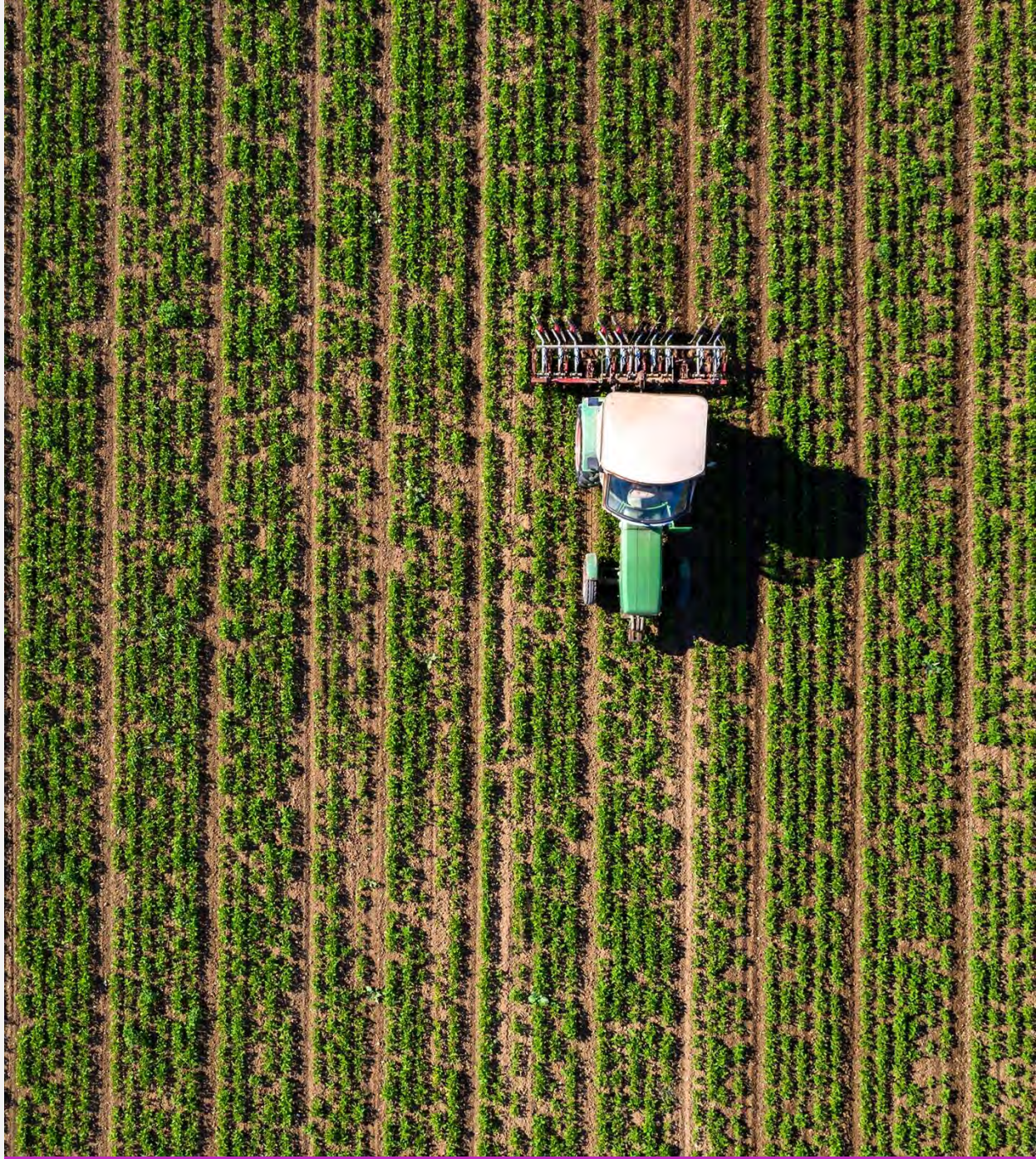
Farming Futures R&D Fund: Low emissions farming

Consortium building event and live Q&A

Chris Danks
Interim Head of Agrifood

Also available via IFS:

- Competition Brief
- Pre-recorded Applicant Briefing



Work on longer-term farming innovation projects → Farming Futures R&D Fund

Summary

Theme

Low Emissions Farming

Total Project Costs

£1-2.5 million

Duration

30-36 months

Demonstrate how the solution **benefits** farming, growing or forestry business **in England**

For **UK businesses** or **Research Organisations** wishing to **collaborate** with other UK organisations
Either can lead

2 stage assessment process with interviews
Projects to start by 1 Jan 2026

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Scope

Develop new solutions to support UK farming working towards achieving low emissions and address **major on-farm or immediate post farmgate** challenges or opportunities.

Must also demonstrate how the solution will **significantly improve on-farm**:

✓productivity

✓resilience

✓ sustainability and progression towards low emission farming

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Scope

- develop ambitious **solutions** that will **reduce emissions in existing farming practices**
- carry out a **life cycle assessment** (LCA) for the solution developed
- demonstrate **impact and measure of carbon** as a number to facilitate foot printing and potential trading, but **other emissions must not be ignored**
- demonstrate and **measure wider environmental benefits**, as contributors to low emission farming
- encourage **dissemination and knowledge exchange** to the wider sector and increase the maturity or market readiness of emerging solutions
- ensure concepts are closely aligned with industry priorities to deliver **business orientated**, transformative opportunities
- Projects must evidence how the solution will **benefit farmers, growers or foresters in England**.

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Specific themes

Address major on-farm or immediate post farmgate challenges or opportunities. Focus **at least on one** of the below areas:

- ✓ Regenerative farming
- ✓ Energy
- ✓ Methanisation
- ✓ Reducing GHG emission in livestock production
- ✓ Innovations to support land management

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Specific themes

Address major on-farm or immediate post farmgate challenges or opportunities. Focus **at least on one** of the below areas:

- ✓ Regenerative farming
- ✓ for example, integration of regenerative techniques into productive systems for improved soil health, water quality and biodiversity.

Projects should maximise the extent of GHG mitigation

Focus on benefit to English farmers and growers

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Specific themes

Address major on-farm or immediate post farmgate challenges or opportunities. Focus **at least on one** of the below areas:

- ✓ Energy
- ✓ for example, increasing efficiency in controlled environment agriculture, improved materials for glasshouses, or energy efficient machinery.

Projects should maximise the extent of GHG mitigation

Focus on benefit to English farmers and growers

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Specific themes

Address major on-farm or immediate post farmgate challenges or opportunities. Focus **at least on one** of the below areas:

- ✓ Methanisation (or biomethanisation)
- ✓ the process based on the natural fermentation of organic matter to produce biogas. Methanisation provides a use for organic waste, producing renewable energy and organic fertiliser. The biogas obtained from methanisation can be used directly to produce heat and electricity and consideration must be provided for the handling of any CH4 and CO2 bi-products, with a focus on on-farm utilisation.

Projects should maximise the extent of GHG mitigation

Focus on benefit to English farmers and growers

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Specific themes

Address major on-farm or immediate post farmgate challenges or opportunities. Focus **at least on one** of the below areas:

- ✓ Reducing GHG emission in livestock production
- ✓ for example, methane inhibiting feed additives, novel housing systems or enhanced breeding.

Projects should maximise the extent of GHG mitigation

Focus on benefit to English farmers and growers

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Specific themes

Address major on-farm or immediate post farmgate challenges or opportunities. Focus **at least on one** of the below areas:

- ✓ Innovations to support land management
- ✓ including productive paludicultural systems; agroforestry, energy crops and biomass production, deployment of biochar for carbon sequestration through application to land, help reduce and reverse carbon emissions from peatland areas

Projects should maximise the extent of GHG mitigation

Focus on benefit to English farmers and growers

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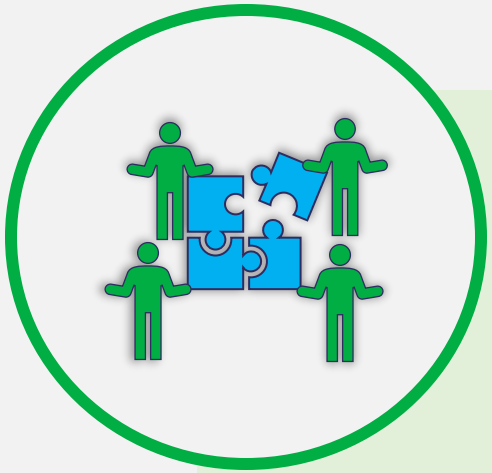
Out of Scope

we are not funding projects that:

- × are not addressing low emission farming priorities as listed in the scope section
- × are not measuring the GHG emissions impact from their innovation
- × are equine specific
- × involve wild caught fisheries
- × involve aquaculture for fish production or human consumption
- × are for the production of crops or plants for medicinal or pharmaceutical use
- × do not benefit farmers, growers or foresters in England

Consortium Building



Collaboration is essential.

The lead can be UK business or Research Organisation (RO).

If the lead organisation is an academic institution or an RTO it must collaborate with 2 UK registered **businesses** of any size.

ROs can **share up to 40%** of the total eligible project costs.

- ✓ Build **diverse consortiums** of innovative agricultural businesses and relevant research expertise with defined roles
- ✓ **Get to know your partnership**
- ✓ **Ensure all partners are fully justified** - *Partners will need to pass financial due diligence*

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Application: tailored questions

- Total 13 mandatory questions
  - Q1-3 are not scored
- Different scored questions:

Question 4	Challenge and ambition
Question 7	Project impact and life cycle assessment
Question 8	Outputs and exploitation (+exploitation plan)
Question 9	Benefits realisation (+logic model)

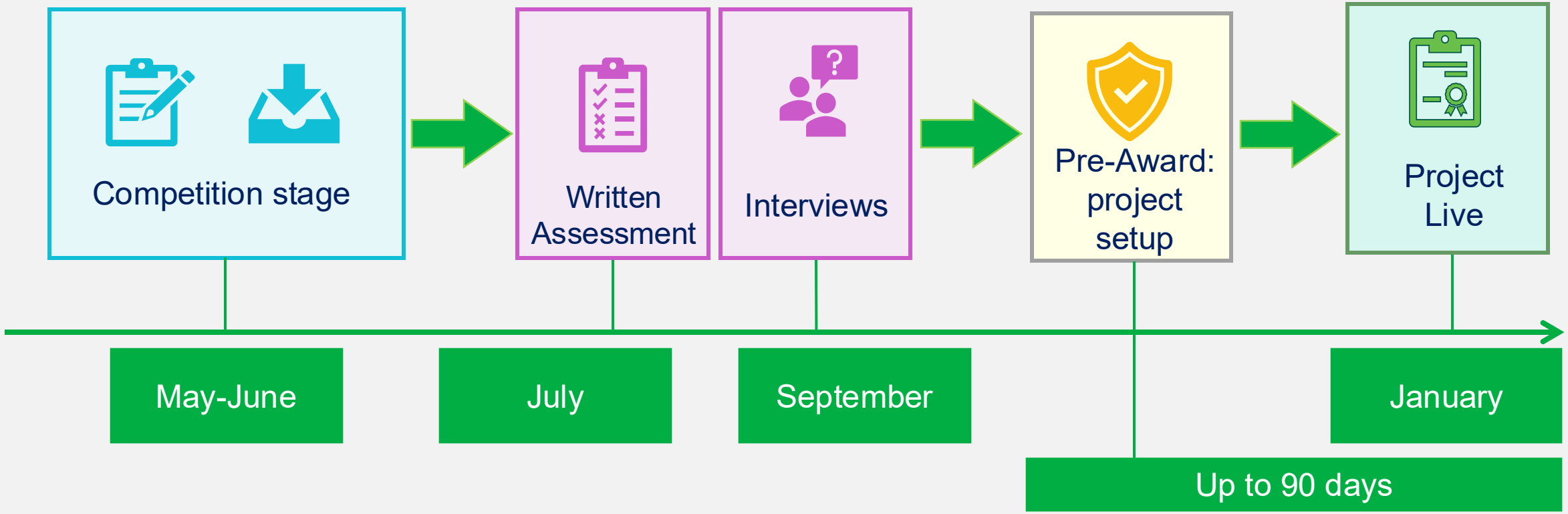
Application: tailored questions

- **Question 4: Challenge and ambition**
- Describe what you expect to achieve from your solution and the overall impact it could have in supporting UK farmers to achieve low emission farming.
- What are the specific greenhouse gases reduction targets and the scale of reduction being sought?
- How will you will ensure your targets and scale of reduction are met ?
- **Question 7: Project impact and Life cycle assessment**
  - How will your project impact be measured?
  - Submit your **expected deliverables** during the project as an appendix.
  - Successful projects may have a Defra appointed third party, carry out an independent LCA on the solution towards the end of the project.

Application: tailored questions

- **Question 8: Outputs and exploitation**
  - How will you exploit, scale up and disseminate your project results?
  - You must submit an **exploitation plan** to support your answer. This can be **updated** during the project, subject to agreement by UKRI.
- **Question 9: Benefits Realisation**
  - What benefits is your project expected to deliver to external parties and over what timescale?
  - Distinguish between benefits you expect to deliver to those both inside and outside your project consortium using the **logic model** template and guidance document.

Application process



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Key Dates

Timeline	Dates
Competition Opens	**5 May 2025**
Submission Deadline	**25 June 2025** at 11am
Applicants informed	**10 October 2025** by 5pm
Project start and end dates	Start by **1 January 2026** End by **31 December 2028**

Hints and Tips

✓**Preparation is Key**

Do not leave this until last minute

✓**Eligibility and Scope**

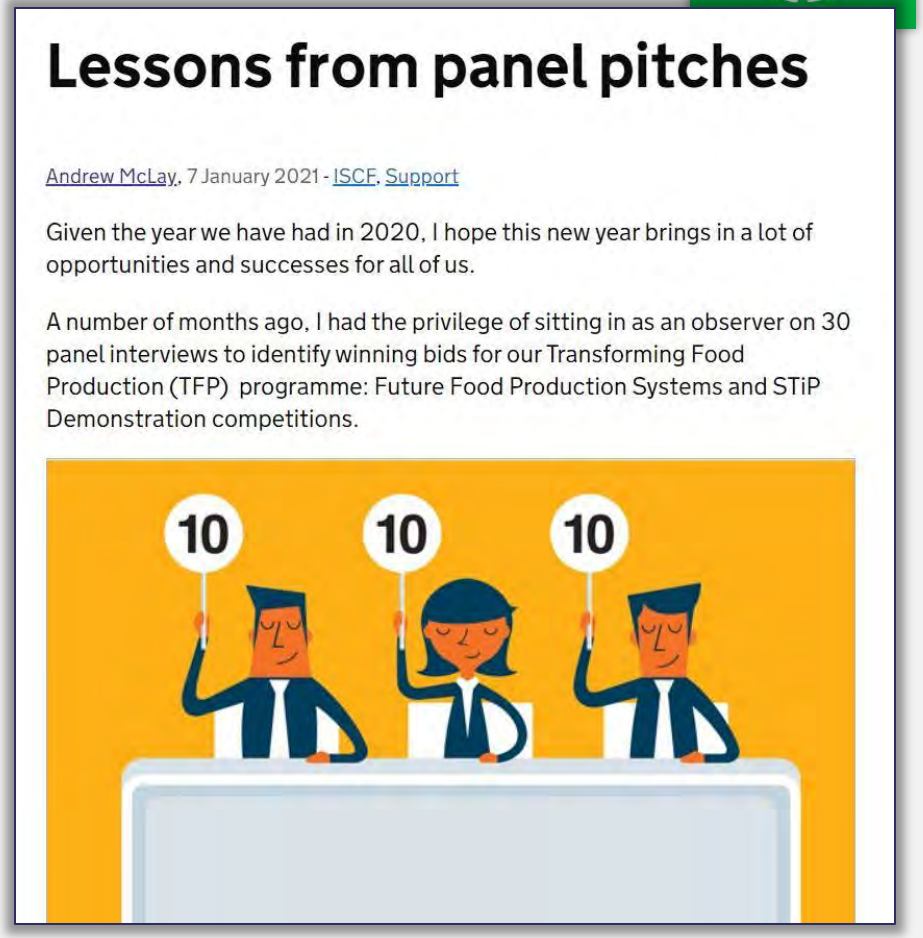
To avoid missing out before assessment

✓**Build up your partnership**

Get to know and understand your partners

Know who you are planning to work with before you commit and make sure all partners are aware of their role and responsibilities

If you apply you will be entering a **competitive process**



Lessons from panel pitches

Andrew McLay, 7 January 2021 - ISCF, Support

Given the year we have had in 2020, I hope this new year brings in a lot of opportunities and successes for all of us.

A number of months ago, I had the privilege of sitting in as an observer on 30 panel interviews to identify winning bids for our Transforming Food Production (TFP) programme: Future Food Production Systems and STiP Demonstration competitions.

https://innovateuk.blog.gov.uk/2021/01/07/lessons-from-panel-pitches/

Contact

Customer Support Services

0300 321 4357 (Monday - Friday 9am-12pm and 2pm-5pm)
support@iuk.ukri.org

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ukri.org/councils/innovate-uk

Innovate UK Business Connect
iuk.ktn-uk.org

Innovate UK Business Growth
www.iukbg.ukri.org

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Q&A Session – 15 minutes

Innovate UK

Farming Futures R&D Fund: low emissions farming

Lydia Smith
Head of NIAB Innovation Farm and Innovation Hub

CENTRE FOR HIGH CARBON CAPTURE CROPPING

IUK

Lydia Smith, NIAB

Why do we need the CHCx3 Project?

- Reducing GHG emissions, and improving resilience to climate change and extreme weather, are global challenges for farming and land management
- UK arable & forage cropping are dominated by few crops, grown as monocultures. Lack of diversity is a risk to the productivity and durability of farming
- Input-efficient crops that can increase C- capture will help farming & industo ity progress toward Net Zero
- But these must achieve profitable, sustainable outcomes

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HIGH CARBON CAPTURE
CROPPING

Centre for High Carbon Capture Cropping (CHCx3) Aims

- 4-year, £5.9M, multi-partner project spanning agriculture, industry and academia, led by NIAB
- CHCx3 will;
  - Help UK farmers/growers capture more carbon and build farm resilience through diversifying their cropping
  - Enable insetting/offsetting of emissions and offer data towards revenue opportunities in the carbon market
  - Support enhanced value chains for industries such as textiles and construction using biorenewables

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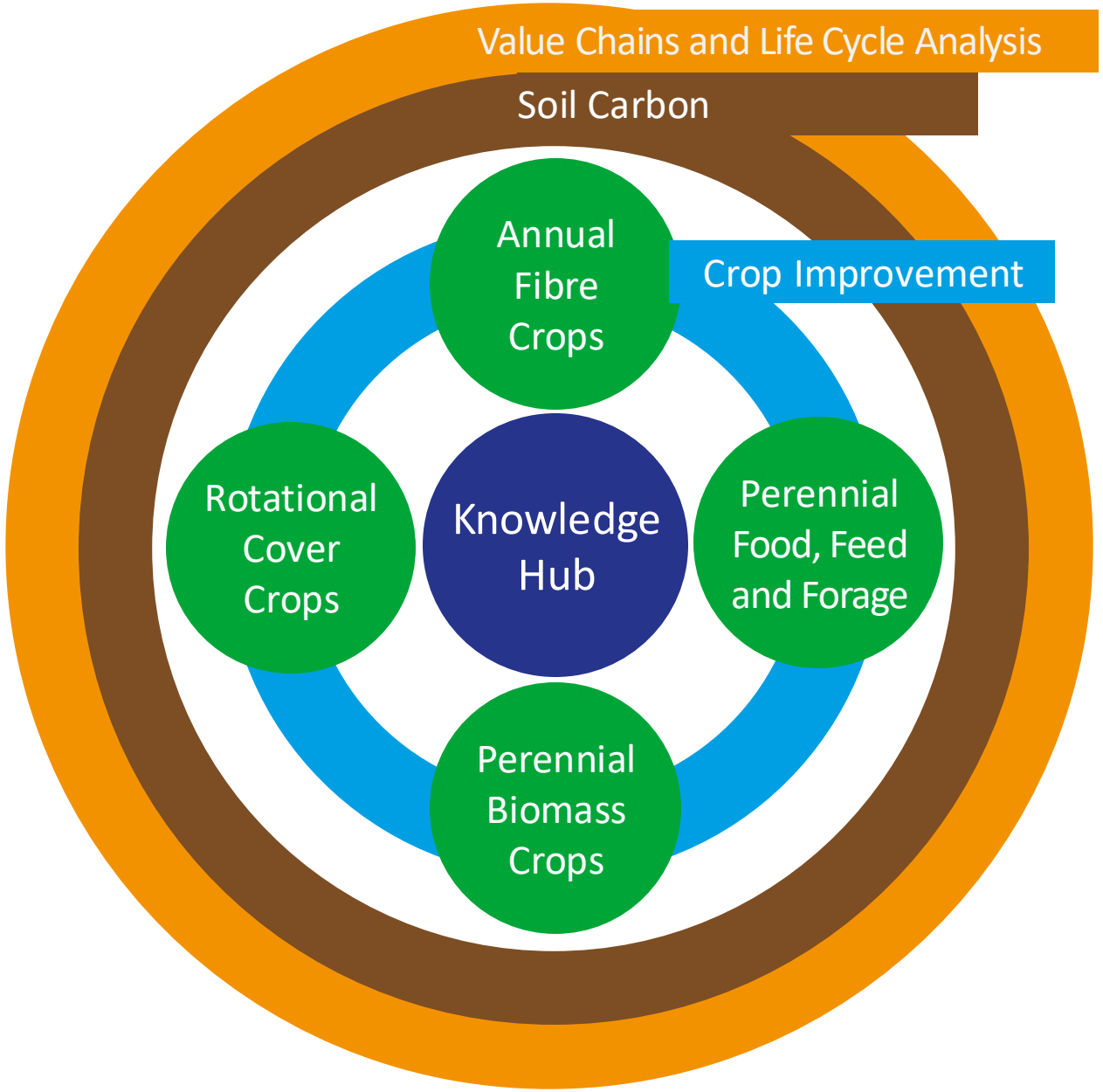
CHCx3 Centre for High Carbon Capture Cropping

Project Lead
Dr Lydia Smith
NIAB



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CROPPING

The Project Proposal – Up to Point of Success

- All of the questions are important including the “boring” ones like risks
- All partners need to get involved in the process and respond to the lead
- Neither too few nor too many partners + all with a real need to be there
- Get the finances right + agreed early; think about a dedicated finance person

- The Lions den interview; don’t just repeat the proposal; they already read it!
- Keep to time … and practice it beforehand … and keep to time !

- If you get through, it is vital to sort out the finances and IUK’s additional documentation in good time (which is not a trivial amount of work)

CHCx3 Partners & Funders

NIAB

BDC Biorenewables Development Centre
Plants • Processes • Products

Bitrez

COTSWOLD Grass Seeds DIRECT

Crops for Energy

Farm Carbon Toolkit

BHA British Hemp Alliance

Elsoms The Seed Specialists

ENERGY CROPS CONSULTANCY
SUSTAINABLY GROWING POWER

FarmED
FARM & FOOD EDUCATION

ROTHAMSTED RESEARCH

terravesta
Growing Innovation

F.C Palmer & Sons

Natural Building Systems

NFU

NIHEMP
northern ireland hemp association

unyte Hemp

UNIVERSITY of York

UK HEMPCRETE

defra
Department for Environment Food and Rural Affairs

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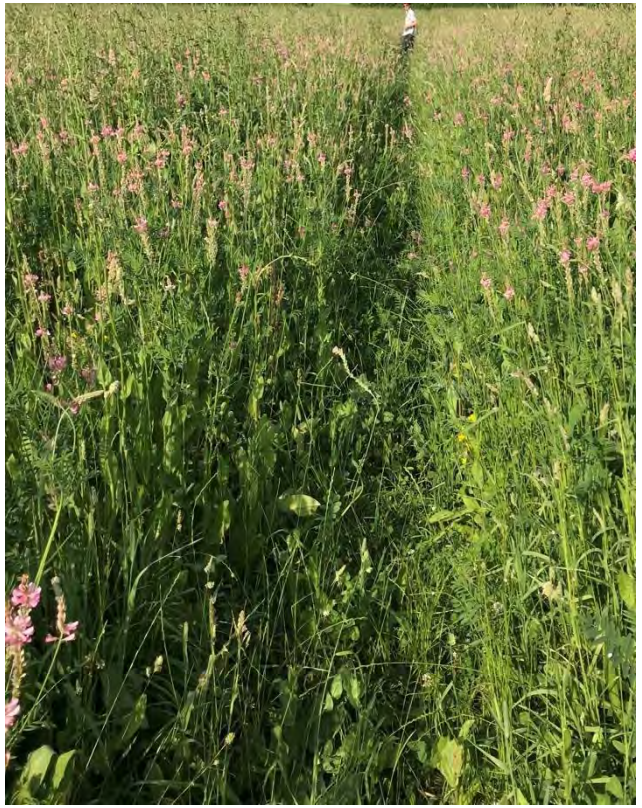
CHCx3 Cropping Options

The economic & environmental potential of 4 crop groups + associated tillage

- Cover crops

- Annual fibre crops hemp & flax



- Perennial food, feed & forage

- Perennial biomass (miscanthus, willow, poplar)

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Perennial forage crops Herbal Leys, Enhanced grazing Meadows & Perennial Food Crops

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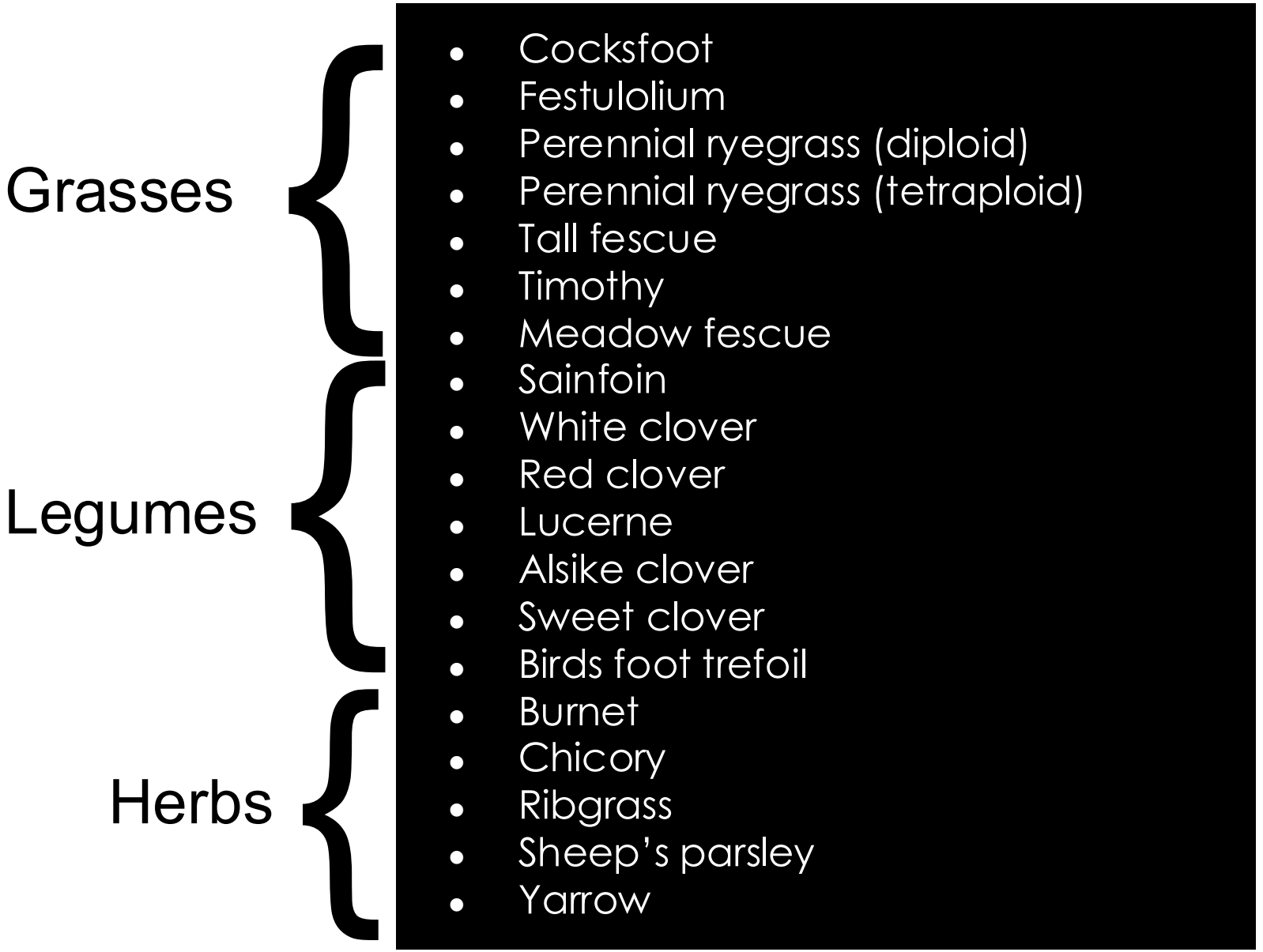
CROPPING

HERBAL LEY MIX, supplied by Cotswold Seeds Ltd.

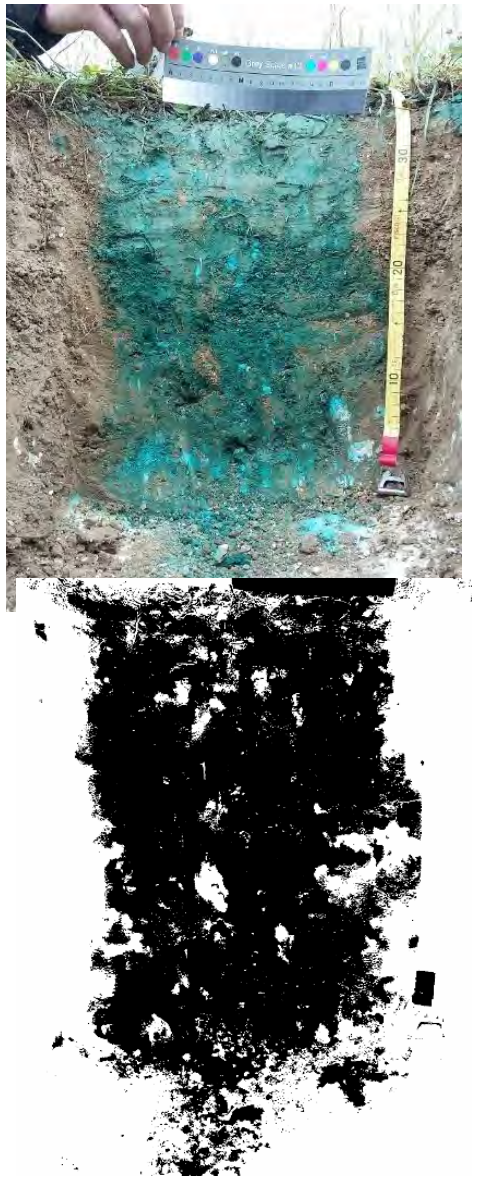


https://www.cotswoldseeds.com/products/542/herbal-grazing-ley-four-year-drought-resistant-ley

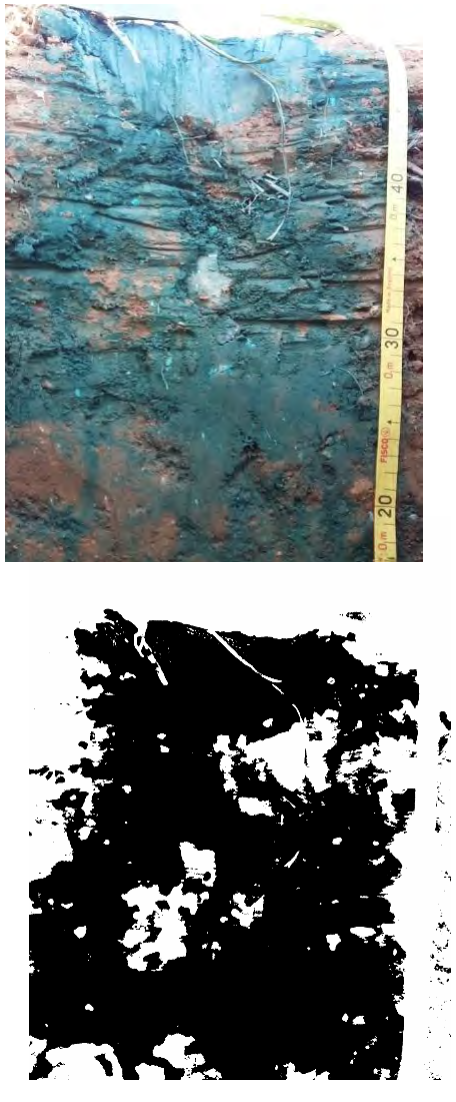
Soil pore structure

Herbal ley

Grass-clover ley

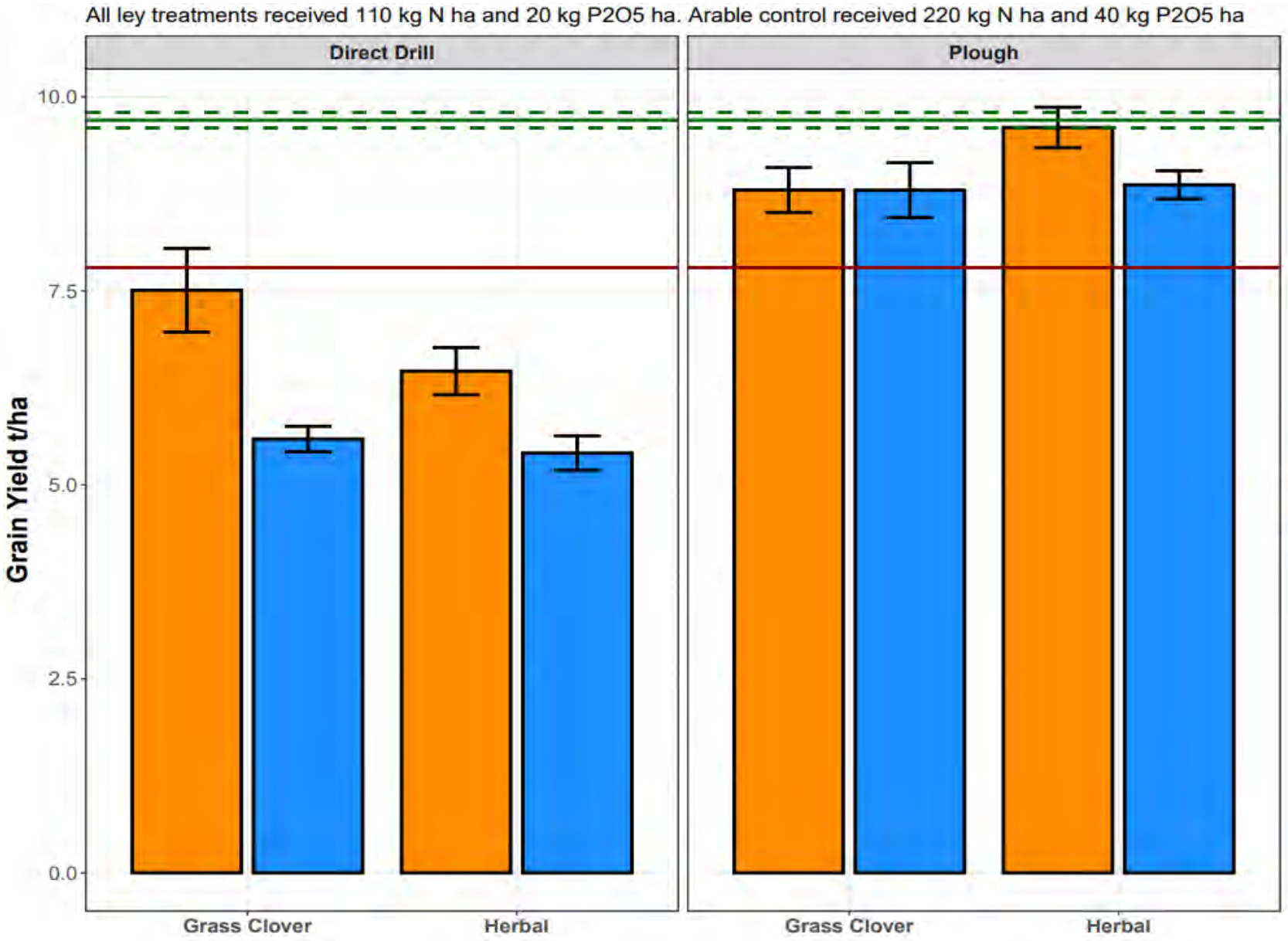


Arable



Emily Cooledge

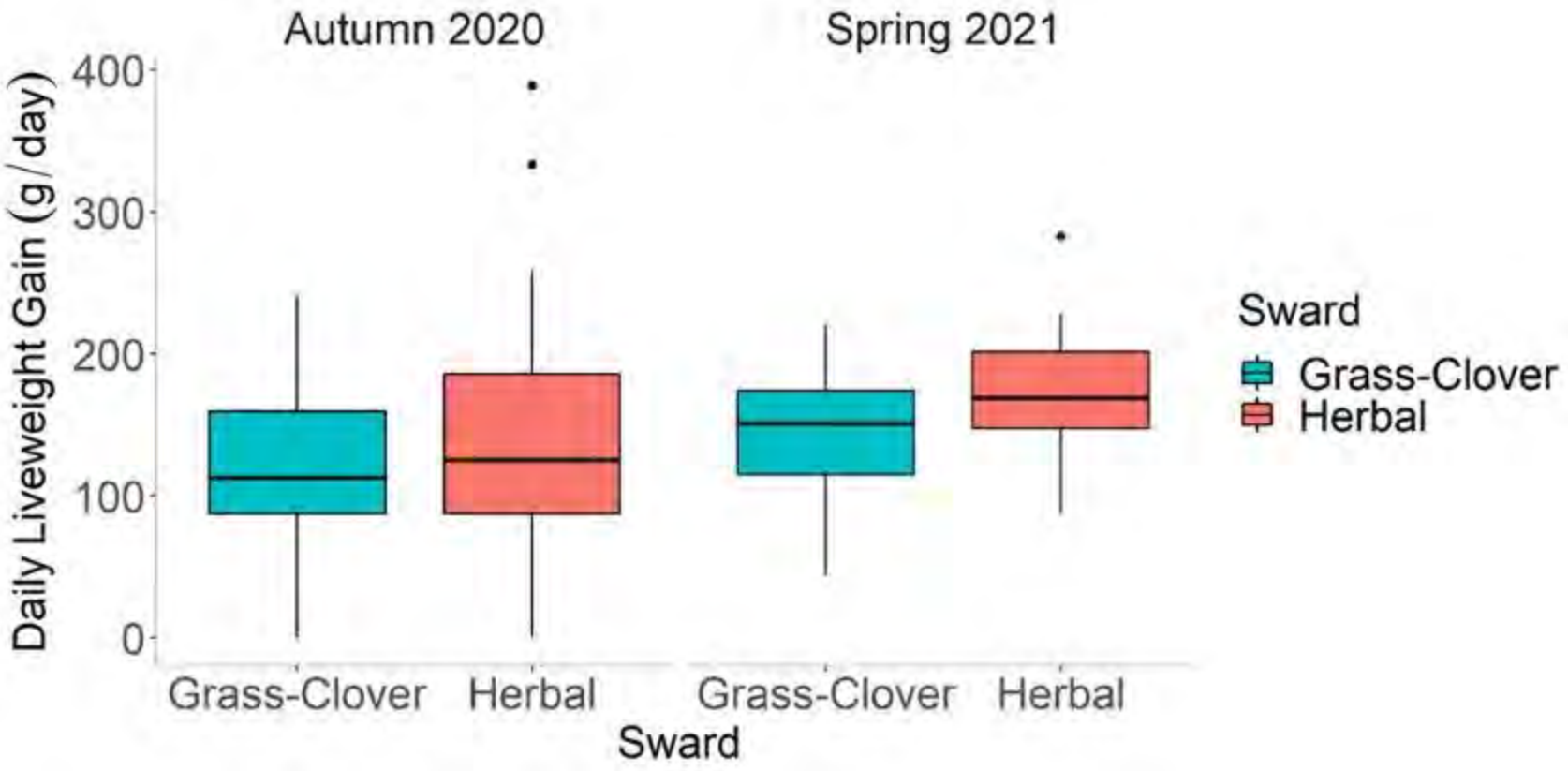
Duxford 2021 Yield Data



Arable Control (240 kgN)

UK Average

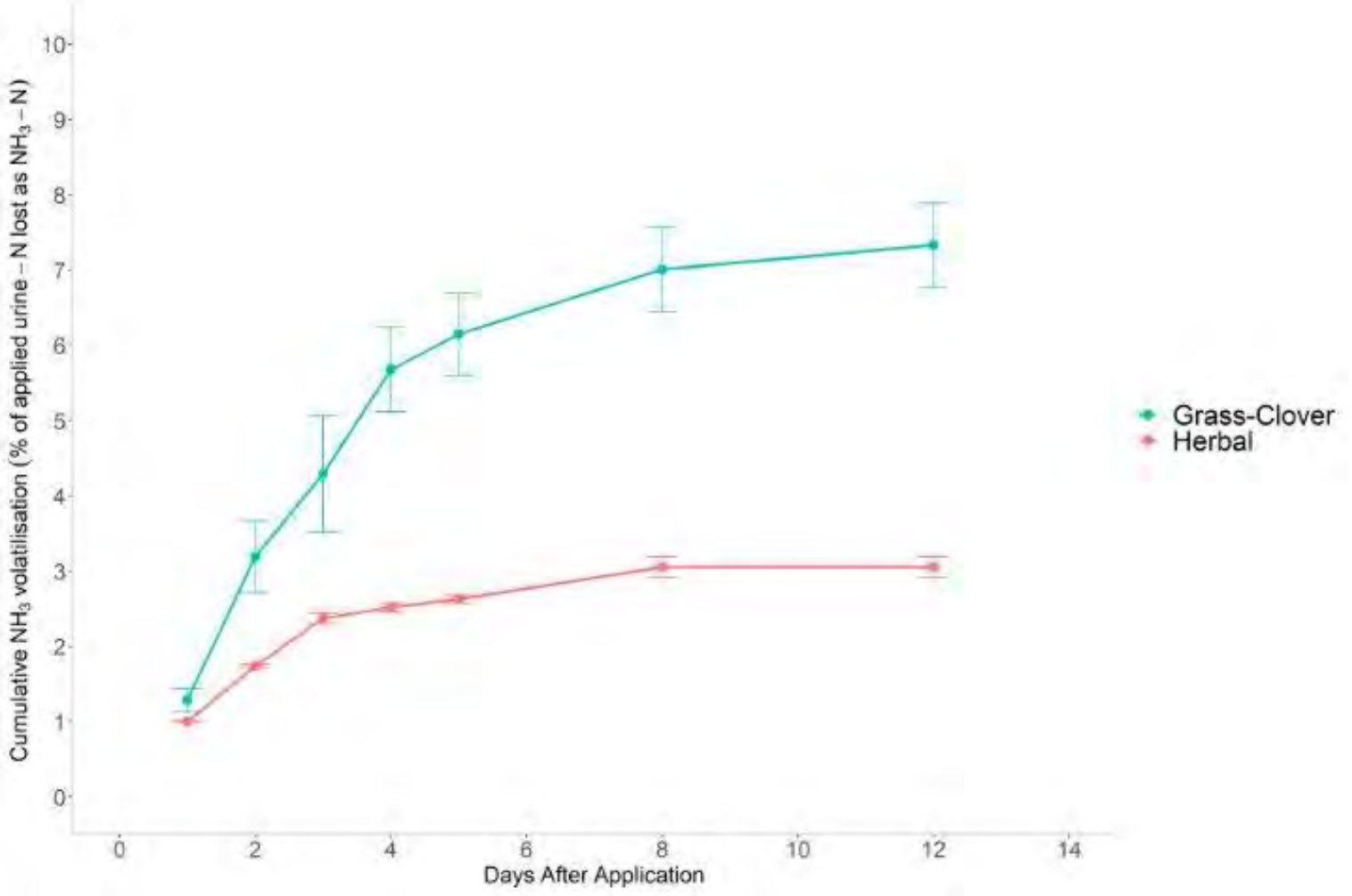
Spring lambs; 15% daily weight gain on Herbal Ley



- **15 %** increase in daily liveweight gain in herbal grazed ewe lambs ($p < 0.05$).
- No statistical difference in ram lamb liveweight gain in autumn 2020 ($p > 0.05$).

Emily Cooledge Bangor Uni.

Urine from labs on herbal ley reduced bench-scale NH_3 emissions



- **58% reduction** in NH_3-N volatilised from urine applied to the herbal ley, measured after 12-days.
- Urine NH_3 volatilisation from the herbal ley was **50% lower** than the UK average for cattle and sheep grazing (6.0 ± 0.7%) (DEFRA, 2019).

Emily Cooledge Bangor Uni.

Novel Mixtures of Alternative Leys

Simple Lolium and clover Ley

Toddington perennial ryegrass

AberWolf perennial ryegrass

Tetraploid perennial ryegrass

AberClyde perennial ryegrass

AberSwan white clover

Merwi white clover

Wild white clover

Medium Diversity 7 Species Ley

AberClyde perennial ryegrass

AberWolf perennial ryegrass

Donata cocksfoot

Winnetou timothy

Merwi white clover

Diplomat red clover

Puna II chicory

Endurance ribgrass (plantain)

Herbal Grazing Ley

Cocksfoot

Festulolium

Perennial ryegrass (2 vars)

Timothy grass

Tall fescue

Meadow fescue

Sainfoin

Red clover, White clover

Sweet clover, Alsike clover

Lucerne

Birdsfoot trefoil

Burnet forage herb

Chicory

Ribgrass forage herb

Sheep's Parsley forage herb

Yarrow forage

No Grass Lamb Finishing Ley

Puna II chicory

Endurance ribgrass (plantain)

Diplomat red clover

Merwi white clover

CENTRE FOR HIGH CARBON CAPTURE CROPPING

Fibre Crops; Flax and Industrial Hemp

Establishment, maturity and retting 2024

Early June

Late August

September

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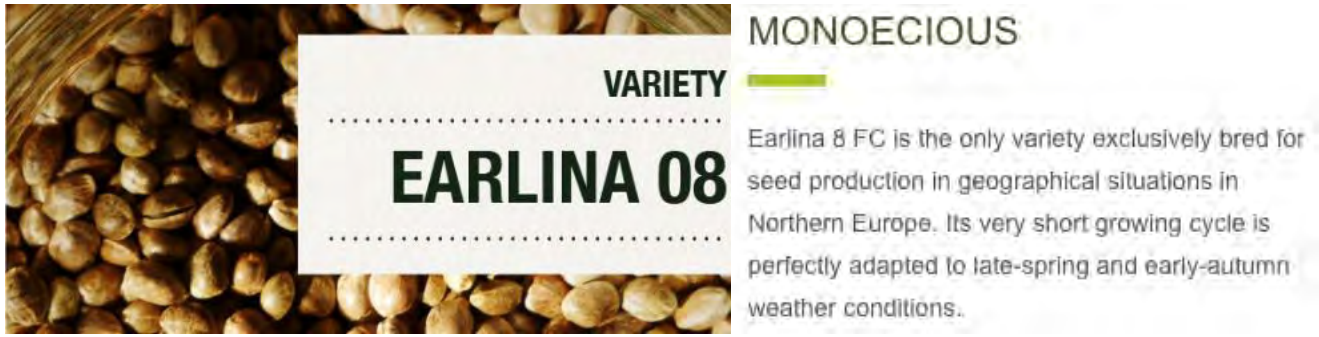
Generating new monecious High Oleic Acid Hemp varieties (& larger seeds)

Source of *csfad2a-1* mutant allele: CNAP1HOH (Finola background)

Recurrent parents:

Earlina 08FC: monoecious seed oil variety with short growing cycle



USO-31: monoecious variety, early seed harvest, high fibre content, large seed

Source: HempIT website

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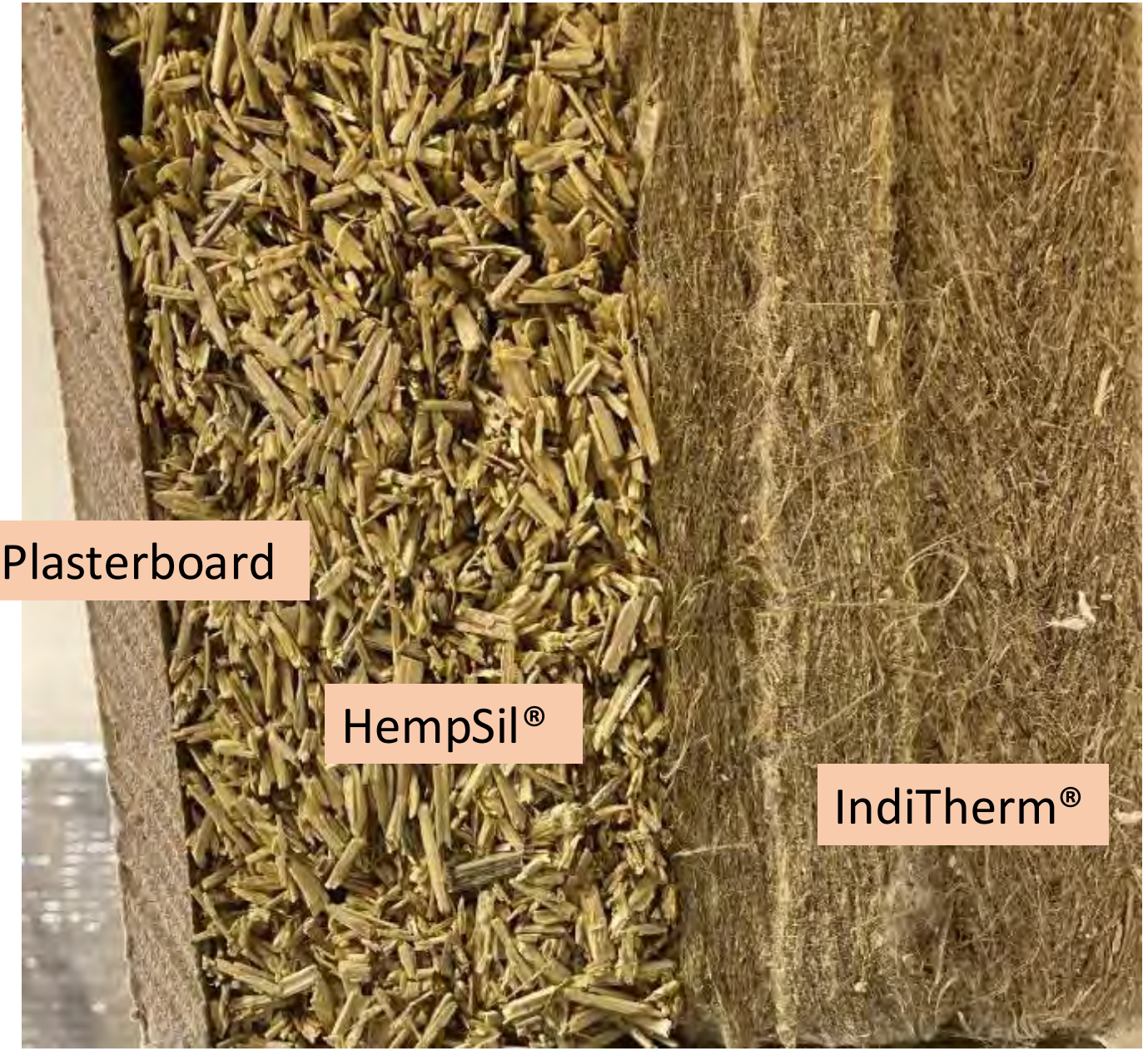
Prof Ian Graham Univ . York

- Acoustic tile product - hemp board + fibre
- Commercial applications as acoustic baffle / panel product & architectural finish
- Supplied as an acoustic finish in Natural Building Systems' meeting pods

Dr Mike Clark Natural Building Systems

Developing Pressed Hemp Board

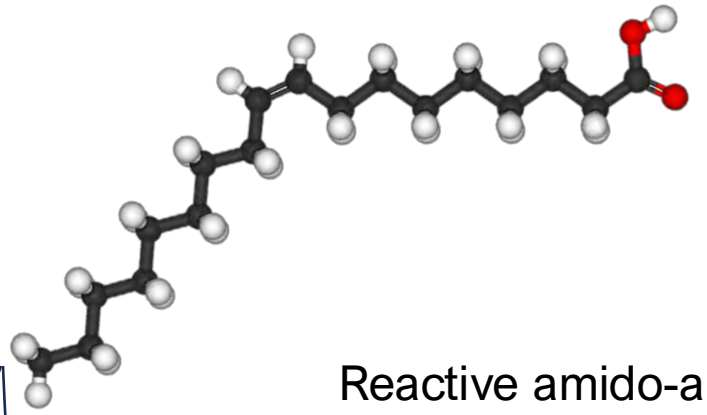
- 600 x 600 mm boards via batch process
- 1200 x 600 mm boards prototyped
- Optimising material and inputs



Hemp products in Retrofit

- Natural Building Systems' is researching and developing commercial retrofit insulation applications for construction
- Centre for Alternative Technology (CAT) optimising performance of retrofit build-ups

Hemp oil products novel uses



Hemp oil

C18 fatty acids **Modifications**

Reactive amido-amines

Used as curatives to cross-link epoxy resins

for RTM and other infusion processing

No latency for hot-melt pre-preg processing

Functionalise

Maleic anhydride

Increase acid functionality

Epoxy modification

Extender for epoxy systems

Inert Plasticiser

Reactive modification

CENTRE FOR HIGH CARBON CAPTURE CROPPING


www.AMS.de
www.AMS.de


IndiTherm
www.indinature.co
IndiNature
Thermal Conductivity λ 0.038-0.040W/m.K
Bulk Density ρ 30-45kg/m³
Acoustic absorption 50mm αw 0.65(H);
70mm αw 0.85(H); 100mm αw 1.00; 140mm αw 1.00
Vapour Diffusion Resistance μ 1-2
Carbon (net storage) -0.70 kgCO2eq/kg
Fire Rating Euroclass E- Pass


ecoshiv
Proud to be part of the Harrison Spinks family
Ultra Compostable
Odour Absorbing
Ultra Low Dust Content
Highly Absorbent
Grown Pesticide Free
Environmentally Friendly
Grown and Processed in the UK

Flax

flax


Main Line Flax - Process Flow
Blended Fibre
Warp
Weft
Singles Yarn
Two Fold Yarn
camira


Main Line Flax - Process Flow
Fibre
Warp
Weft
12.5% Stone (dyed flax)
12.5% Undyed (ecru flax)
12.5% Sage (dyed flax)
12.5% Nectar (dyed flax)
40% Green (dyed wool)
70% Undyed (ecru wool)
5% Beige (dyed wool)
5% Tan (dyed wool)
30% Lemon (dyed wool)

Biomass crops; Willow, poplar & Miscanthus

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Mature plantation using improved germplasm

Harvesting Biomass Crop

- Direct Chipping harvester
- Cut and chipped in two phases

- 20-22 ton / ha / annum equivalent to 30 m^3/ha/an
- Cycle for 5-6 years – 1600 poles/ha
- Clones planted using improved germplasm

Cover Crops

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Improving soil health… AND capturing carbon

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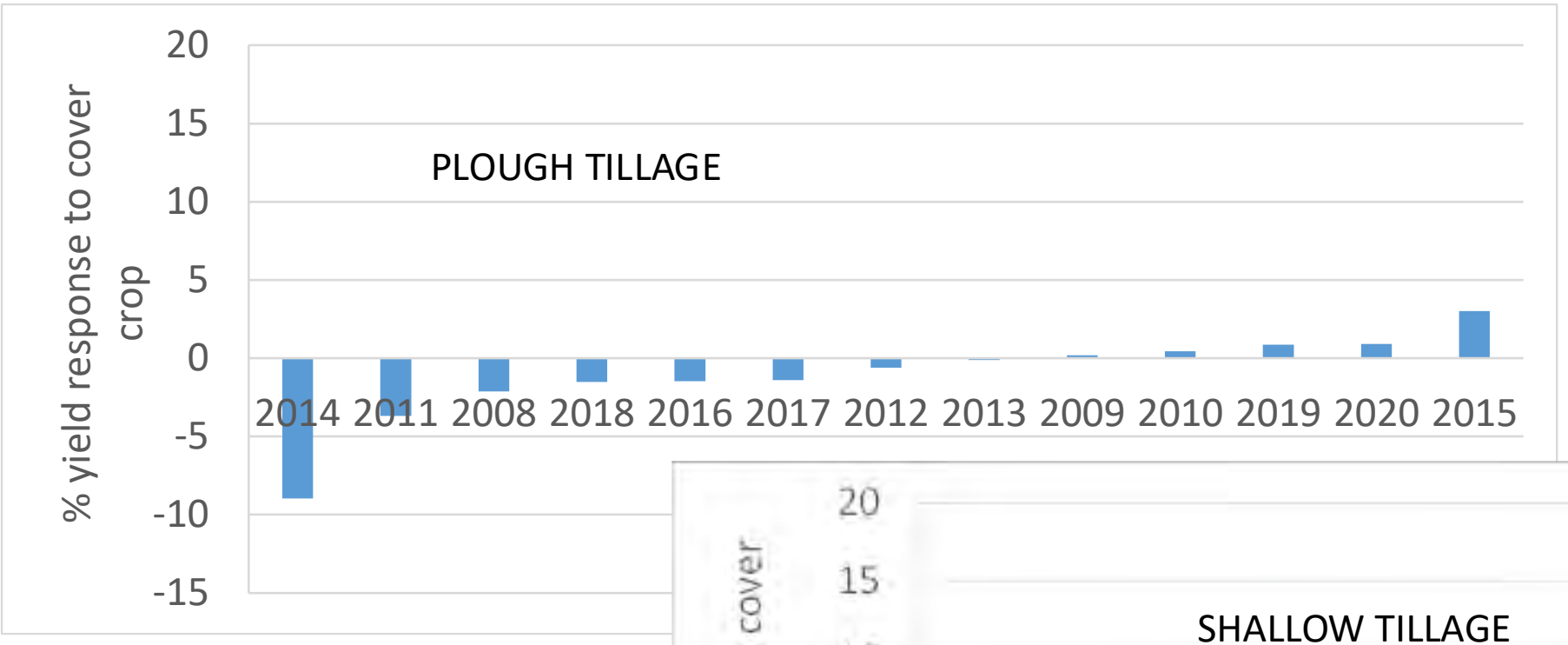
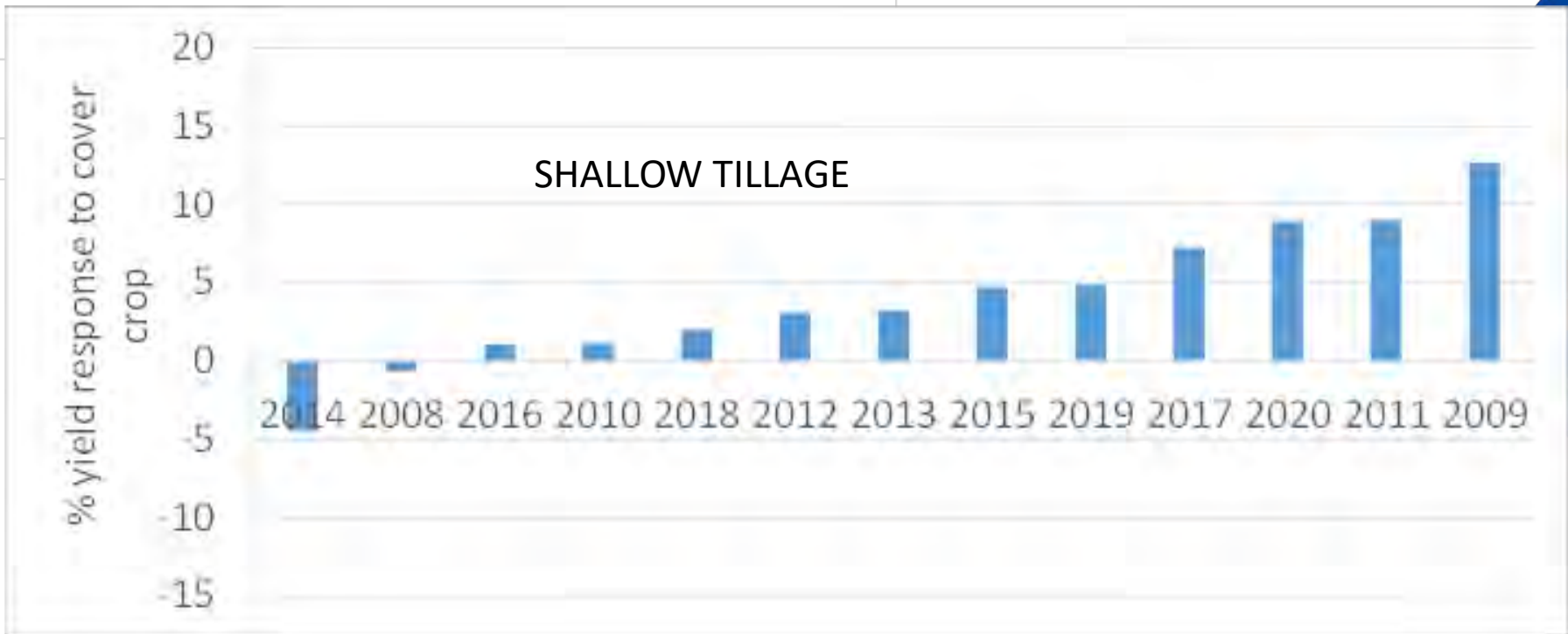
Yield response (%) Cover Crops in a long-term cultivation study



Nathan Morris NIAB



THE MORLEY AGRICULTURAL FOUNDATION

JC Mann Trust

CENTRE FOR HIGH CARBON CAPTURE CROPPING

Crop growth – 07/10/2024

Improved crop growth from earlier sowing;

- Timing 1 Aug 20
- Timing 2 Sept 2
- Timing 3 Sept 10 2024

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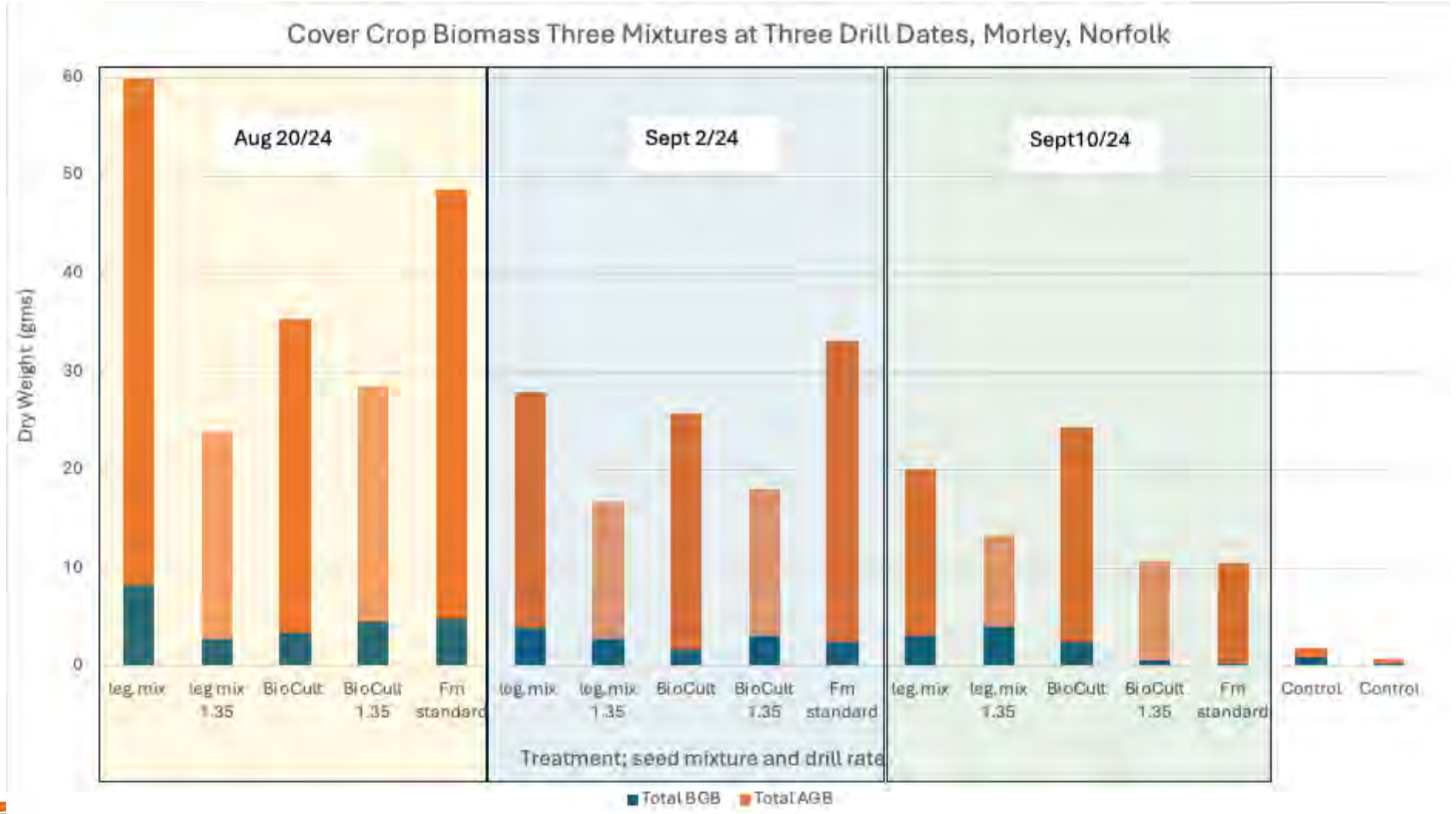
CROPPING

Cover crop Biomass results for 2024-5 Morley



HIGH CARBON CAPTURE CROPPING

The Project Proposal – AFTER Success

- All of the questions are STILL important including the “boring” ones like risks
- All partners need to remain involved in the process and respond to the lead
- If partners and can’t complete the work its better that they leave
- Keep an eye on the finances and report any worries soon

- The nominated PMO is amazing; so use him or her
- If there are problems with spending the money tell them at once

- Don’t forget to keep good records of every dissemination and outreach you do along the way

CENTRE FOR
HIGH CARBON CAPTURE
CROPPING

Contact Us

Email: chcx3@niab.com

Find out more by scanning the QR code or at:

www.carboncapturecropping.com

Sign up for our free e-newsletter and events


CENTRE FOR HIGH CARBON CAPTURE CROPPING

INSIGHTS

The newsletter of the Centre for High Carbon Capture Cropping January 2025

Viewpoint Page 2 | Research in Focus Page 3 | News from the Hub Page 6 | Meet the Partners Page 8 | Meet the grower Page 10 | Get involved Page 12

Editorial:

Stuart Knight, NIAB, CHCx3 Knowledge Hub Leader

Welcome to the fourth edition of CHCx3 Insights, the newsletter of the Centre for High Carbon Capture Cropping, or 'CHCx3' for short.

When the National Farmers' Union (NFU) set its target in 2019 of achieving net zero greenhouse gas (GHG) emissions by 2040 across agriculture as a whole in England & Wales, I'm sure no-one was under any illusion as to how difficult that would be. The most recent government figures, issued in July 2024, highlight that we still have a mountain to climb. UK total GHG emissions from agriculture for 2022 were 47.7 MtCO2e, accounting for 12% of all UK GHG emissions. Whilst nitrous oxide and methane, which together make up around 85% of the GHG emitted from agriculture, have fallen since 1990 by 23% and 15% respectively, emissions of carbon dioxide have not, and the proportion of all UK GHG emissions that derive from agriculture has increased.

Whilst none of us knows when, or even if, we will reach our destination, every change that we can make that captures more carbon and reduces emissions takes us one step closer, adding ever so slightly to the sustainability of farming and the industries that utilise its outputs. Within CHCx3 we continually see and hear about opportunities within the selection, management or utilisation of crops that could directly or indirectly contribute to the net zero journey.

In 2025 we will see many more chances to engage with the CHCx3 research and Partners, participate in free events, and access information and resources to support productive carbon capture cropping. If you are interested in getting more involved in CHCx3 or have a suggestion as to how else we can help, please do get in touch. Our contact details are provided on the last page of this newsletter.

In this edition of Insights, Dr Helen Ferrier, Chief Science Adviser at CHCx3 partner NFU, gives her viewpoint on Lobbying success for hemp growers. James Pitman from Farm Carbon Toolkit highlights the Farm Carbon Calculator and Jamie Bartley of Unyte Hemp outlines new field studies to investigate the carbon potential of fibre crops. In 'News from the Hub' we highlight new developments in carbon capture cropping from CHCx3 and elsewhere. We hear from CHCx3 partners Crops4Energy and British Hemp Association on their aspirations for carbon capture cropping, and from herbal ley grower Mark Spendlove.

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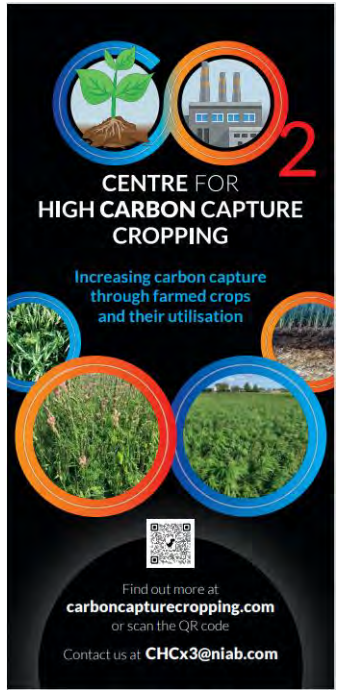

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CHCx3 is funded by Defra under the Farming Futures R&D Fund: Climate Smart Farming. It forms part of Defra's Farming Innovation Programme, delivered in partnership with Innovate UK.

CENTRE FOR HIGH CARBON CAPTURE CROPPING

Farming Futures R&D Fund: low emissions farming

John Henry Looney (UK Agritech Centre)
Visiting Professor in Sustainable Energy Systems and Techniques at University of Lincoln and Managing Director at Sustainable Direction Ltd

Life Cycle Assessment (LCA) in the Agricultural Industry

8th May 2025

Today's Objectives

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This session will cover the following

1. Understanding LCA fundamentals
2. Data Collection and Management
3. Collaboration with Specialist
4. Integration of LCA in Research
5. Value Stream Mapping and LCA

Understanding LCA fundamentals

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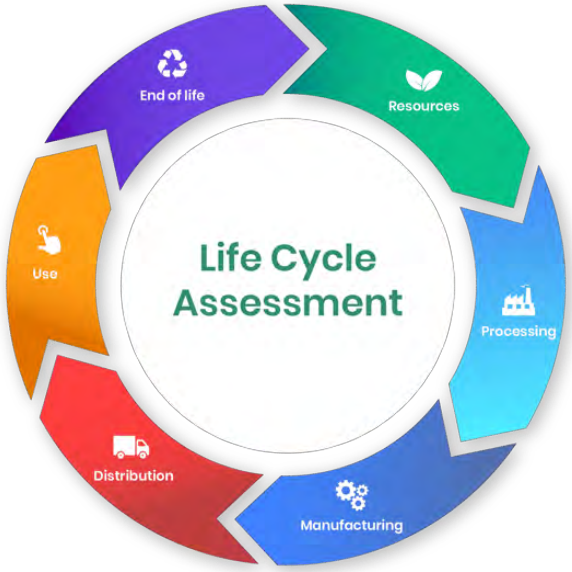
- What is an LCA?
- Stages of LCA
  - Goal and Scope
  - Inventory Analysis
  - Impact Assessment
  - Interpretation
- Why is LCA useful in Agriculture

Outcome

Understand the principles and applications of LCA in agriculture.



What is an LCA?

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"A Life Cycle Assessment (LCA) is defined as the systematic analysis of the potential environmental impacts of products or services during their entire life cycle".

"Life cycle impact assessment (LCIA) covers all relevant inputs from the environment (e.g., ores and crude oil, water, land use) as well as emissions into air, water and soil (e.g., carbon dioxide and nitrogen oxides).

The International Organization for Standardization provides guidelines and requirements for conducting a Life Cycle Assessment according to ISO 14040 and 14044".

Stages of LCA?

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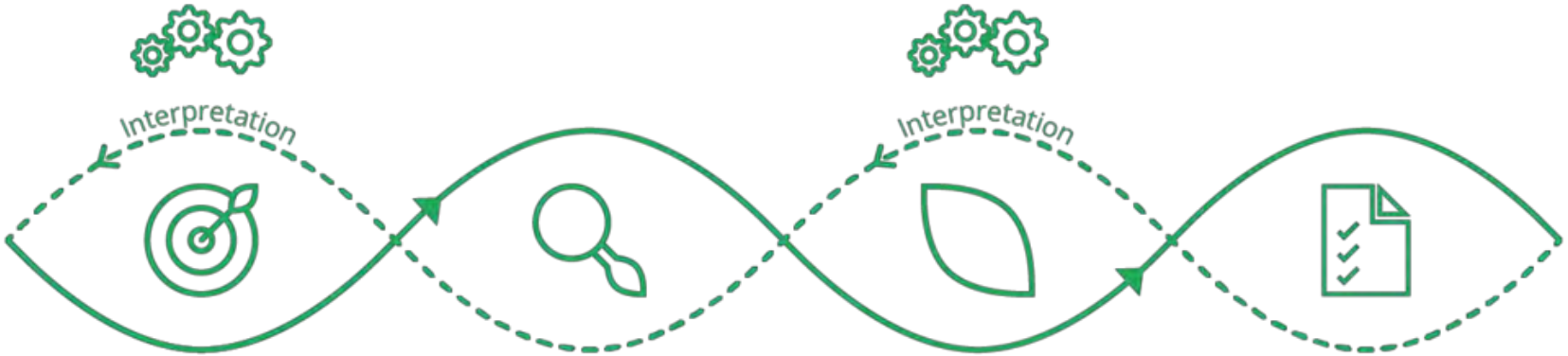

Goal & scope definition → Inventory analysis → Impact assessment → Direct applications

Life cycle assessment framework

- Product development and improvement
- Strategic planning
- Portfolio assessment
- Organizational footprint
- Capacity building
- Other

Stages of LCA (Goal and Scope)

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In this phase, you define:

- The purpose of the LCA, the functional unit (the unit of comparison), system boundaries, assumptions, and limitations.
- The intended audience and the context in which the results will be used.
- What product or service would be assessed?
  - Define the functional unit (e.g., 1kg of strawberry)
  - Define the system boundaries (next slide)
  - What are some of the assumptions for this product (e.g., soil fertility)
  - Are there any limitations (e.g., uncertainty of data)
  - Will the results be presented to stakeholders or to the public. This will determine if a critical review is needed

Stages of LCA (System Boundaries)

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System boundaries defines which inputs, outputs and time boundaries are considered within an LCA.

- Cradle-to-gate: Includes the raw material until it leaves the factory gates.
- Cradle-to-Cradle: Considers the products impact from the extraction to the end-of-life and reuse again
- Gate-to-gate: sometimes used in product cycles with many value-adding processes in the middle.

- Also temporal, i.e. multi year perspectives

Stages of LCA (System Boundaries)

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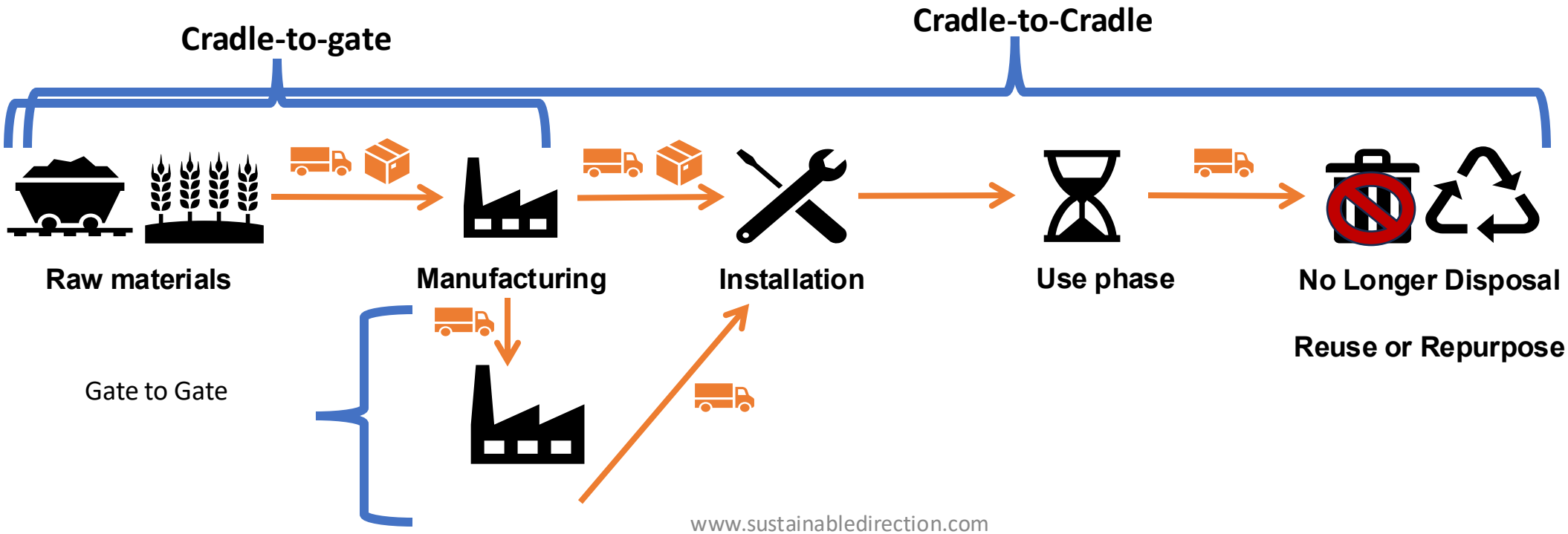
System boundaries defines which inputs, outputs and time boundaries are considered within an LCA.



Life Cycle Inventory Analysis (LCI)

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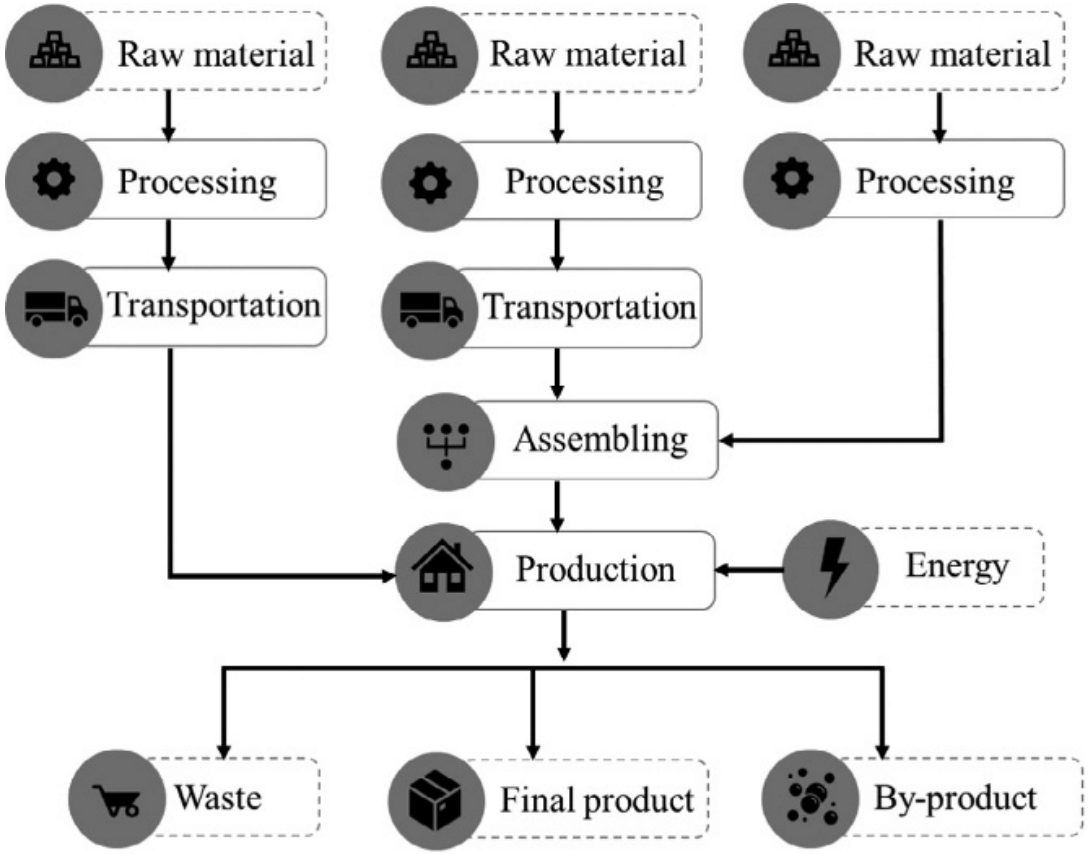
- Collect data on inputs (e.g., raw materials, energy, emissions and waste) throughout the product life cycle.
- Identify data sources and quantifies materials and energy flows



Scope 3 – as outlined by the GHG Protocol

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Upstream Emissions

1. Purchased good and services
2. Capital goods
3. Fuel and energy related activities
4. Upstream transportation and distribution
5. Waste generation in operations
6. Business travel
7. Employee commuting
8. Upstream leased assets

Downstream Emissions

9. Downstream transport and distribution
10. Processing of sold products
11. Use of sold products
12. End-of-life treatment of sold products
13. Downstream leased assets
14. Franchises
15. Investments

Stages of LCA (Impact Assessment)

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Which Impact is better or worse?

While carbon footprint is a crucial indicator of environmental impact, it does not provide a complete picture of a product's overall sustainability.

The environmental impact of a product depends on multiple factors, including **acidification, eutrophication, land use, water consumption, and resource depletion**. Some products may have a relatively **low carbon footprint** but contribute significantly to other impact categories.

For example, **bio-based plastics** may have a lower carbon footprint compared to conventional fossil-based plastics; however, their production can lead to **higher land use change, deforestation, and increased water consumption.**

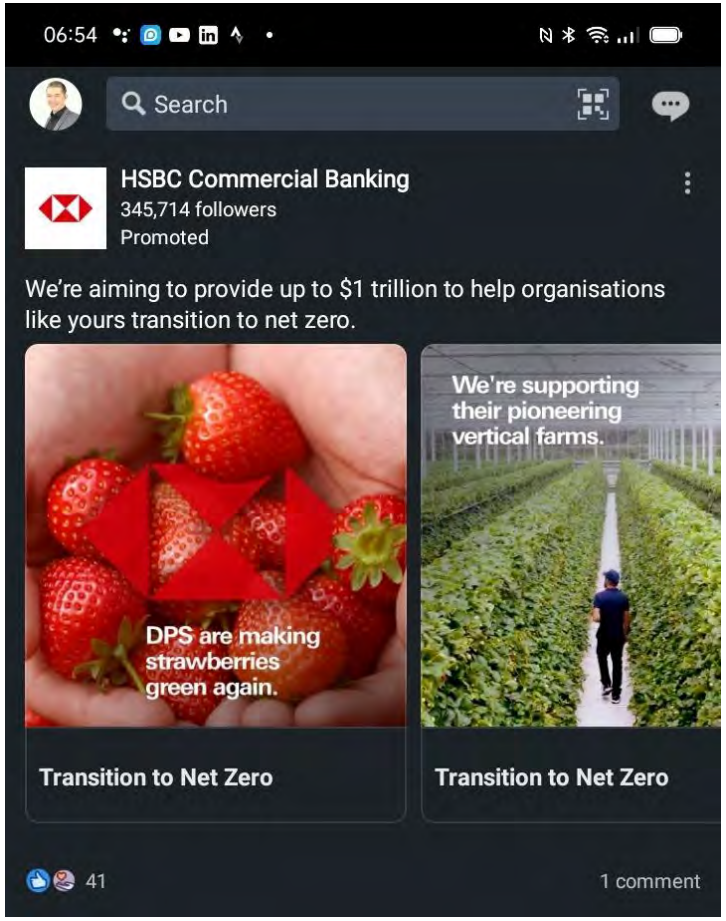
Why is LCA useful in Agriculture

LCA is useful for both

- the robotics/ agritech projects, and
- the plant / soil / regen improvement projects

- The same logic applies, to compare the environmental outcomes from one option to another or multiple options

- The environmental reports are then combined with the economic and social outcomes to prepare a sustainability report.



Integrating with Research – Case Study 1

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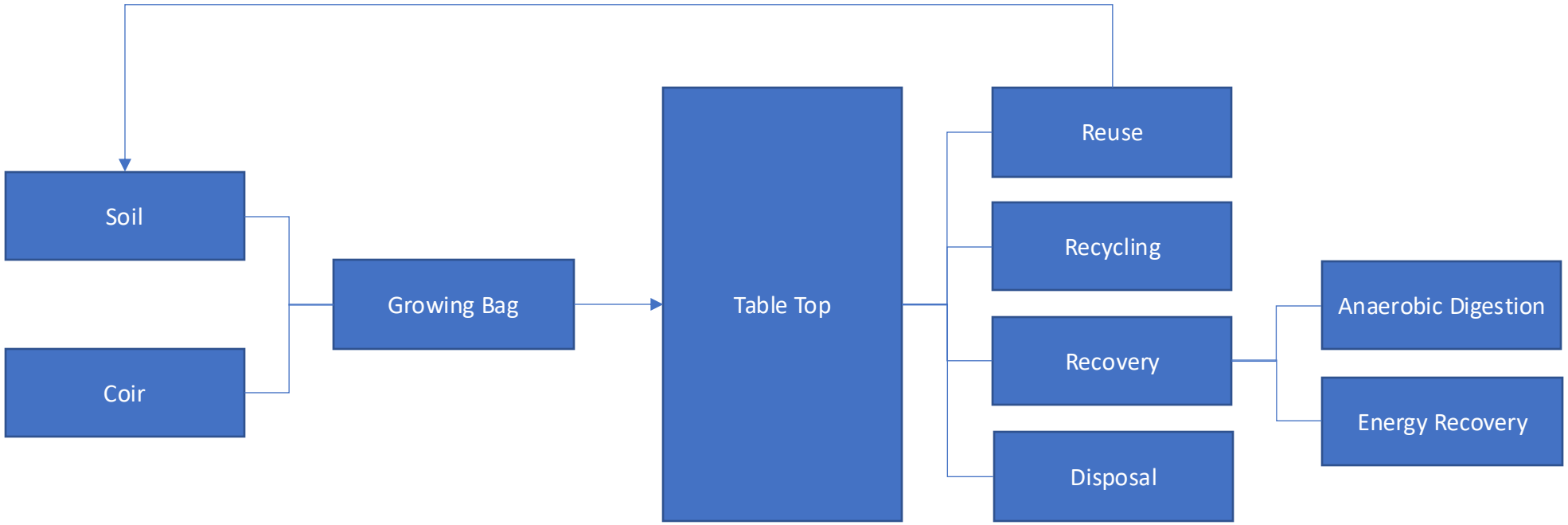
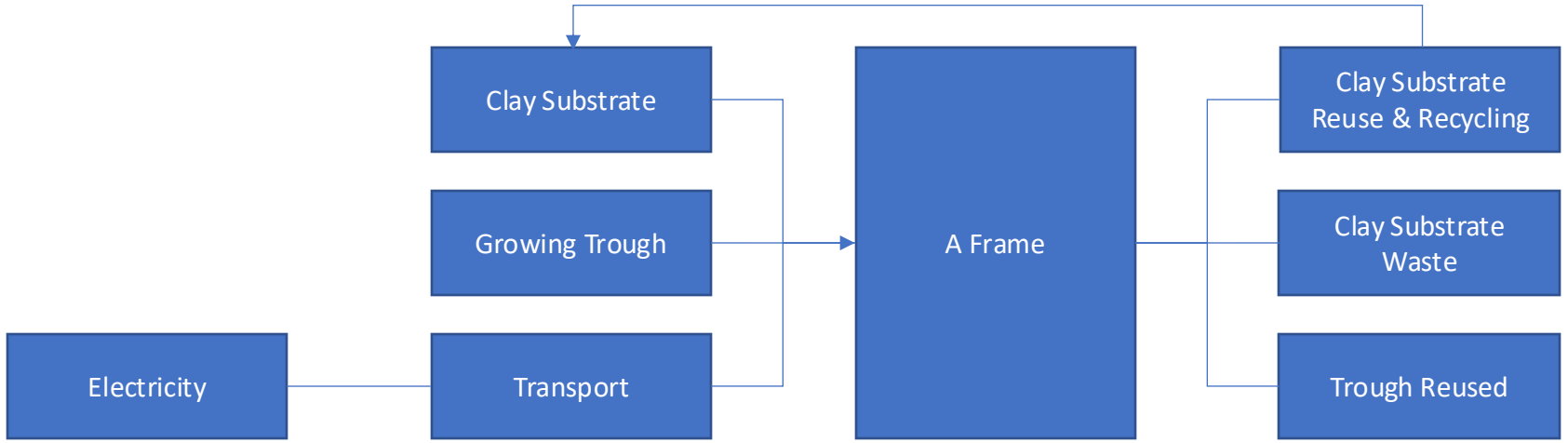
	Baseline – Table-top	Hydroponic System
Location	UK Based	UK Based
Growing Structure	Growing strawberries in polytunnels using table-top	Growing strawberries in glasshouse using new approach
Growing Media	Plants grown in organic media contained in plastic growbags	Plants grown in substrate growing media contained in reusable and recyclable troughs
Water Use	Rainwater harvesting and groundwater abstraction	Rainwater harvesting and groundwater abstraction
	Water applied direct to growbags, that can freely drain and infiltrate the ground	Water flows through growing troughs, accessible direct to plant roots
	Some wastewater capture, treatment (filtration) and recirculation)	Nutrient rich water is collected in holding tanks Water quality checked, corrected, and recirculated
Climate Control	Climate within polytunnel controlled	Climate within glasshouse controlled
	Liquid CO_2 to elevate CO_2 concentrations	Liquid CO_2 to elevate CO_2 concentrations
	Liquid Natural Gas (for heat) and exhaust gas recirculation	Using Liquid Natural Gas (for heat) and exhaust gas recirculation
	Humidity control	Humidity control
Plant care	Pesticides and fertiliser used	Pesticides and fertiliser used
	Biocontrol techniques	Biocontrol techniques
Harvesting	Crop harvested	Crop harvested
	Crop sorted by quality grading	Crop sorted by quality grading
Dispatch	Crop packaged in plastic punnets	Crop packaged in RPet punnets

Integrating with Research – Case Study 1



Integrating with Research – Case Study 1



Integrating with Research – Case Study 1

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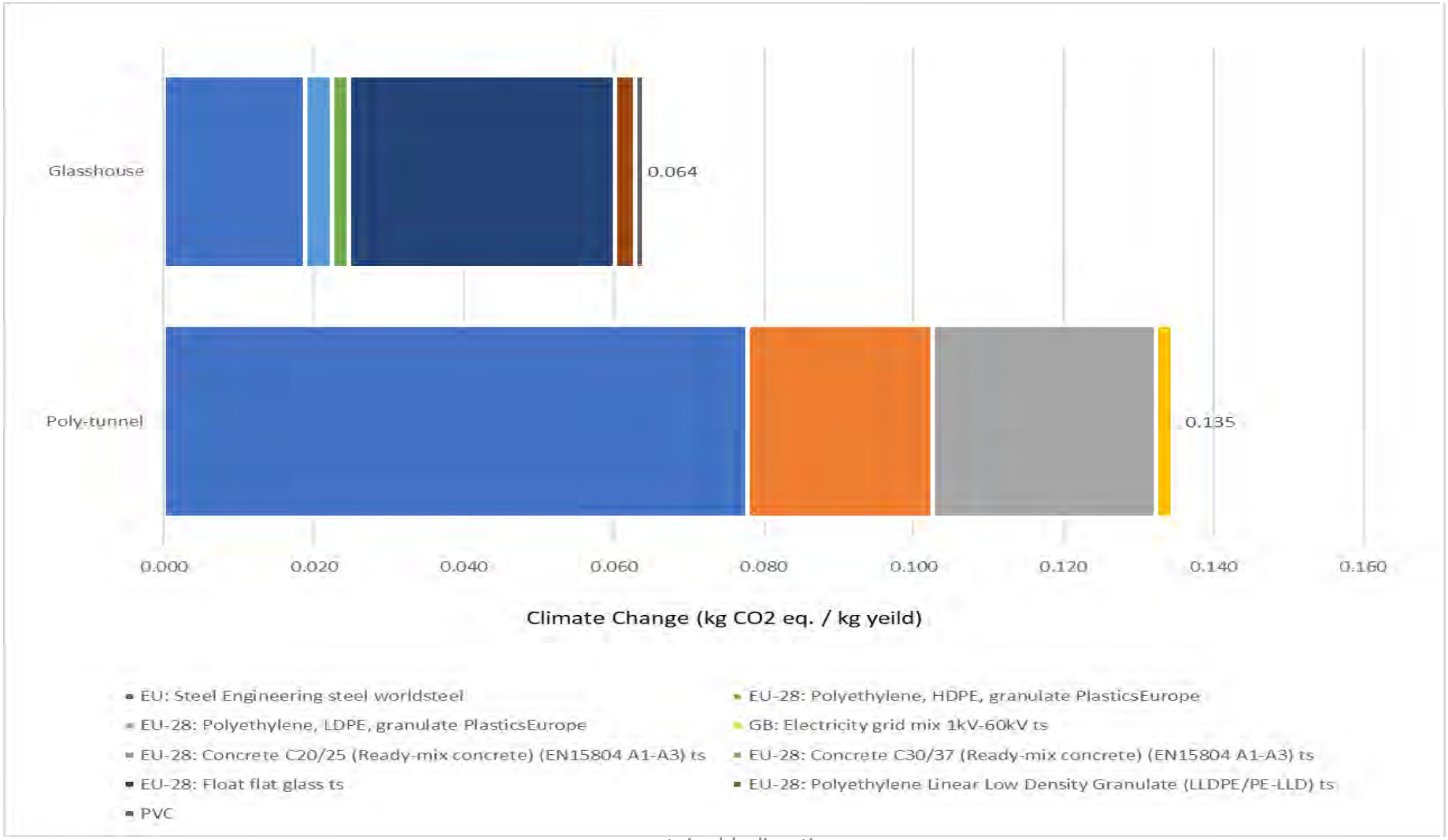

Integrating with Research – Case Study 1

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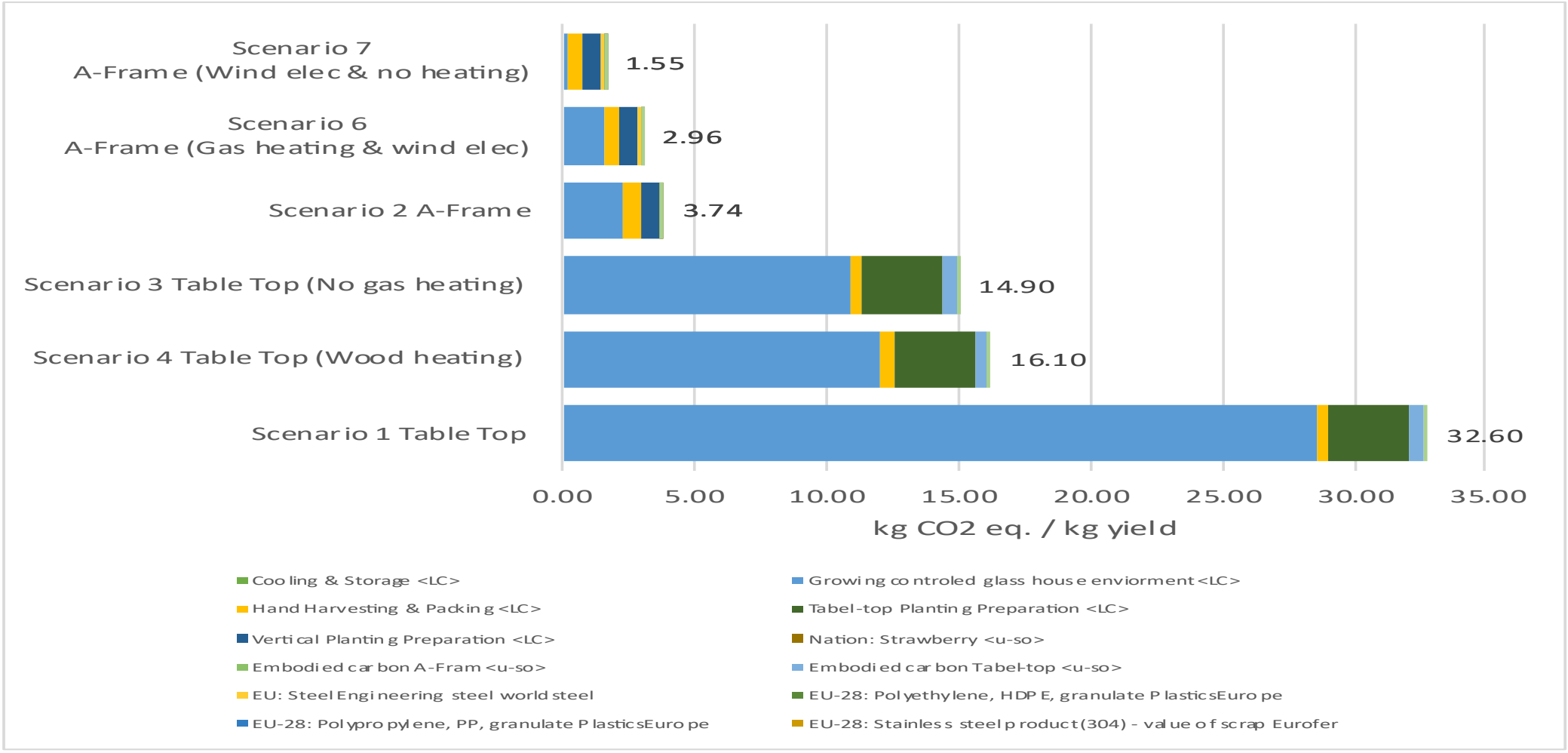
New Design

Tabletop

kg CO2e / kg yield



Integrating with Research – Case Study 2

How is the Pollution Generated? – Case Study 2

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Current chilled & frozen food transport utilises specialist refrigerated vehicles

- Diesel-powered, ‘donkey-engine’ chiller units - up to 20% of vehicle diesel usage
- Heavy, insulated bodies
- Inflexible, temperature-zoned payload areas
- Door openings => loss of cold air

“A smart, secure, affordable means of containing and transporting temperature-sensitive produce from producer to consumer, reducing pollution, food waste and the requirement for mobile refrigeration.”

LCA of the system (Predicted) – Case Study 2

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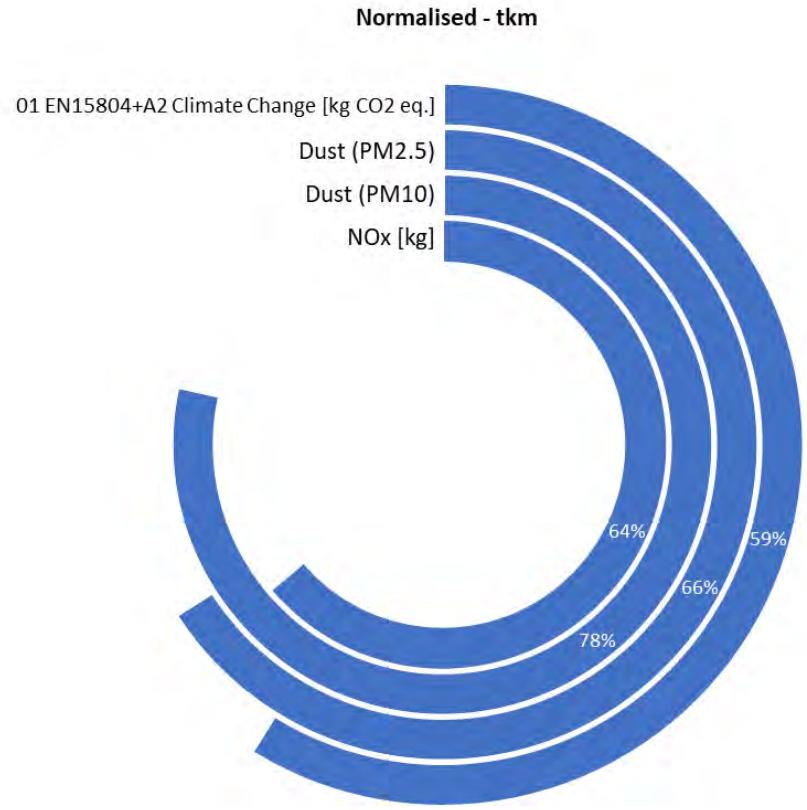
- **Operational vs Embodied Impacts (kg/tonne/km)**
  - ~99.8% of impact associated with vehicle and direct emission
  - 66% - 86% from road fuel
  - 11% - 32% from conversion and on-vehicle refrigeration systems
  - 1% - 3% embedded in chassis
- **Local Air Quality (18t scenario)**
  - NO_x
    - 20% reduction in absolute (kg)
    - 37% reduction normalised (kg/tonne/km)
  - Particulates (PM_{10})
    - 31% reduction in absolute (kg)
    - 45% reduction normalised (kg/tonne/km)
- **Climate Change (CO_2 equivalent)**
  - 26% reduction in absolute (kg)
  - 41% reduction normalised (kg/tonne/km)



Environmental Benefits – Case Study 2

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Output results correlate with other comparable sources:

LCA estimates CO2 saving from just 18t vehicles of

- 90 million kg CO2 pa

Varied data-sets available within LCA.

- Sensitivity analysis conducted to confirm most appropriate data sets
- Most representative (and not best-case) data used.

LCA outputs needs further ground-truthing

- Deployment on vehicle and real-world testing to confirm
- Vehicle energy loading intensity
- Operational energy recharge intensity

Preliminary Findings

On an 18t vehicle, we could achieve an additional load capacity of ~2t

To deliver 30t needs:

Four conventional refrigerated vehicles…

…but only <u>three</u> with Hubl!

LCA input to the Sustainability Reports

- LCA will provide content for the Sustainability / Circular Economy Report and Deliver a Medium High-Level Assessment of a Whole Life Cycle Analysis to compare new approaches with the traditional approaches.
- The Sustainability Report – describing the material, energy and carbon outcomes, as well as social and financial outcomes, based on a KPI per unit of product, of
  - New approach methods, vs
  - Existing Commercial Production

A new way of understanding what you do.

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Business / Process Understanding

- Value Stream Mapping
  - Process Flow Diagrams
    - Energy Mass Balance
      - Life Cycle Analysis
        - Environmental Product Declarations
          - Circular Economy

Outputs	Time optimisation and cost
	Process Control and Optimisation
	Resource Use Optimisation
	Use per Functional Unit
	Environmental Impacts (Water, Energy, Ecology, Carbon, Air, etc.) and EPDs
	Your Role in the Circular Economy
	Improved Value

Thank You

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CARBONZERO

Comfort break – See you in 10 minutes

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Networking Session

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Collaboration Document

- Document containing all the participants from today who agreed to be included.
- Helps to make collaboration and consortium building easier.
- Issued with our follow up communication and recordings

Innovate UK

Available support

- **JOIN OUR LinkedIn Group**
  - **Farming Innovation Programme: Finding Information and Partners**
- **Sign up to our monthly newsletter**
  - AgriFood Newsletter
- Additional questions regarding scope should be sent to support@iuk.ukri.org

Find out more:
https://iuk-business-connect.org.uk/
https://iuk-business-connect.org.uk/agrifood/

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Innovate UK Business Connect Team - helping you to making introductions

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- Christopher Till, **Agrifood** team christopher.till@iukbc.org.uk
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- Amy Waite, **Energy** team amy.waite@iukbc.org.uk
- Isabel Cook, **Net Zero** team isabel.cook@iukbc.org.uk

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Themed breakout rooms – Session 1 and 2 (15 mins)

1) Introduce yourself: name and organisation.

2) Give a brief description of...
   - ...your expertise/offer.
   - ...what you are looking for in a partner.

3) Choose which room you wish to enter and you will need to join yourself

Regenerative farming: integration of regenerative techniques into productive systems for improved soil health, water quality and biodiversity

Methanisation: (or biomethanisation) is a process based on the natural fermentation of organic matter to produce biogas. Methanisation provides a use for organic waste, producing renewable energy and organic fertiliser.

Energy: for example, increasing efficiency in controlled environment agriculture, improved materials for glasshouses, or energy efficient machinery.

Reducing GHG emission in livestock production: for example, methane inhibiting feed additives, novel housing systems or enhanced breeding.

Innovations to support land management: including productive paludicultural systems; agroforestry, energy crops and biomass production, deployment of biochar for carbon sequestration through application to land.

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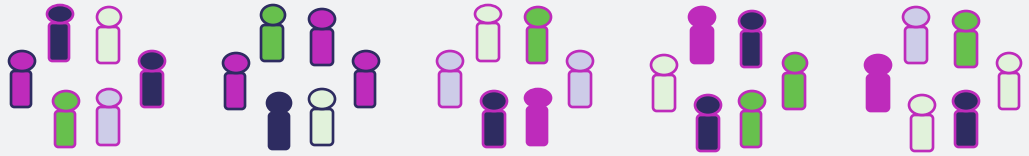
Breakout room session 3 (10 min)
Random



1) Introduce yourself: name and organisation.
2) Give a brief description of...
    - ...your expertise/offer.
    - ...what you are looking for in a partner.
3) You will be randomly selected a room

Remember to switch on microphone and camera

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Thank you

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