



CENTRE FOR
HIGH CARBON CAPTURE
CROPPING

INSIGHTS



The newsletter of the Centre for High Carbon Capture Cropping

January 2025

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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.



Viewpoint

NFU

Lobbying success paves the way for hemp growers

Current industrial hemp licencing rules, which allow the cultivation of varieties containing less than 0.2% THC (Tetra Hydro Cannabinol), are set to be changed to make it easier for farmers to grow the crop following NFU lobbying efforts.

Growers have previously complained that the current licencing arrangements and application process disincentivise hemp production, despite its huge potential to diversify both farming businesses and crop rotations. To help alleviate these concerns, the NFU has worked with both Defra and the Home Office to develop a fairer, more accessible set of licencing agreements. At a time when increasing disease and pest pressure is making other traditional break crops more difficult to grow in the UK, the NFU hopes that these changes will allow more growers to include hemp within their crop rotations.

Previously, growers applying for a licence to grow hemp have faced a long list of restrictions as to which fields the crop can be grown in, a requirement that many have viewed as over-burdensome at a time when greater flexibility on farms is key. However, under the proposed new regime, which is expected to be implemented in time for the 2025 growing season, licence holders will now be able to grow hemp anywhere on a licenced farm, so long as they avoid planting in fields adjacent to sensitive sites such as schools and playgrounds.

A further two changes to licencing agreements are then expected to be implemented ahead of the 2026 growing season. The first will see the maximum term for which licences are issued extended from three to six years. This is important not only in allowing growers to plan for the medium term, but also because many supply agreements take place over a five year term meaning many growers were previously unable to commit to growing hemp due to uncertainties regarding licence renewal.

The second change expected for the 2026 season is that growers will now be able to defer the start date of their licence by up to one year. This will make farm business planning significantly easier and relieve the stress previously experienced by some growers for whom licences have been issued just days before drilling work needed to commence.

The NFU believes these changes are wholly positive and are indicative of what can be achieved when the



industry and government work together to achieve positive results for growers. Looking to the future, we will continue to work with government to ensure that growers have access to the varieties they need to thrive in a rapidly evolving marketplace. The government has already stated that it has asked the Advisory Council on the Misuse of Drugs to provide input regarding whether the THC levels in industrial hemp might safely be raised from 0.2% to 0.3% and the NFU looks forward to working with government and industry partners on this matter.

CHCx3 Research in Focus



Jamie Bartley, CEO at Unyte Hemp

Exploring the carbon potential of fibre crops: Research on hemp and flax

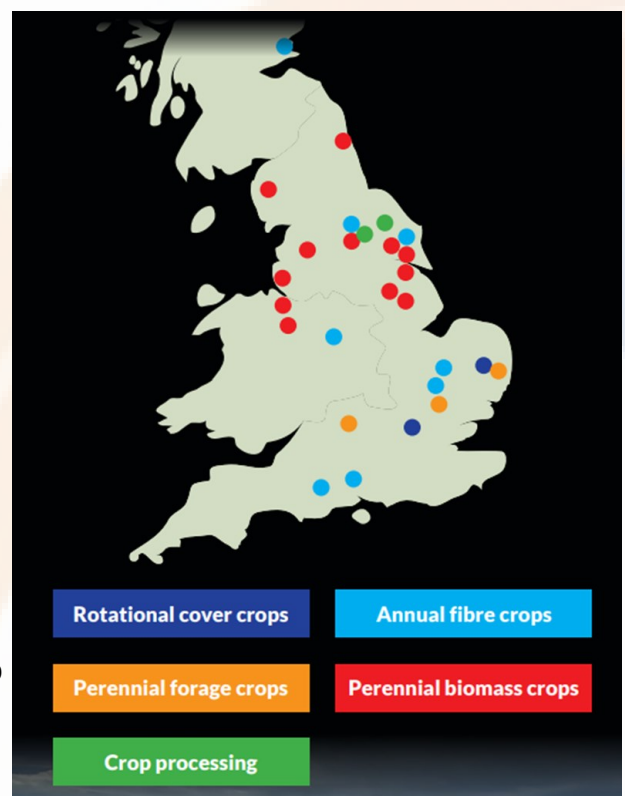
Fibre crops like industrial hemp, *Cannabis sativa* (low THC varieties only), and flax, *Linum usitatissimum*, offer promising solutions to carbon sequestration and sustainable materials, with applications extending across the construction, textile, automotive and bioenergy sectors. As part of the CHCx3 research initiative, [Unyte Hemp](#) is leading a focused effort to assess and enhance the potential use of these annual fibre crops. Our aim is to generate the data needed to substantiate the environmental and economic viability of hemp and flax, supporting their expansion within the UK's agricultural framework and carbon-smart farming.

Evaluating Carbon Capture and Soil Benefits

CHCx3 partners Unyte Hemp, [Elsoms Seeds](#), [Niab](#), FC Palmer & Sons and the [University of York](#) are conducting trials on hemp and flax crops and their products across the UK. These trials are part of a strategic approach to pinpoint the most effective genotypes and management practices for maximising carbon capture, alongside fibre and shiv production for a range of uses. Two of the key questions we aim to answer are:

1. What are the optimum conditions for carbon capture in hemp and flax?
2. How can we measure their contribution to soil health and long-term carbon sequestration?

Elsoms' field trials sites span a variety of climate conditions, soil types and depths, and environmental factors such as shelter, moisture levels, and prior land use. The light blue dots on the map show the location of the annual fibre crop trials in the CHCx3 project. This approach will help us identify how these factors influence both above-ground carbon storage in biomass used in various products and below-ground carbon retention in soil. Furthermore, we are investigating novel retting methods and improving the current understanding of the different components involved in the process. Additionally, we are exploring tillage regimes that can help enhance the carbon-storing benefits of hemp and flax, particularly in marginal land areas that would benefit from enhanced soil health and soil organic matter content.



Scaling Up for the Future of Carbon Farming

The outcomes of these field trials will inform a series of grower guides and best practice documents tailored to UK conditions. By providing farmers with accessible data on hemp and flax varieties, carbon capture metrics, and economic potential, we aim to create a foundation for fibre crops to become a mainstream option for climate-smart agriculture. Further, verified carbon capture data will support Unyte Hemp's efforts in developing carbon credits, enabling farmers to monetise their environmental stewardship through emerging carbon markets.

Building Value Chains for Sustainable Materials

As hemp and flax cultivation expands, so too does the need for robust processing and supply chains that can meet market demand for sustainable biomaterials. Unyte Hemp, alongside partners like UK Hempcrete and Natural Building Systems, is working to establish efficient, scalable processing models. This includes evaluating mobile pre-processing units, which can reduce logistical costs and support the decentralised production of hemp-based materials such as shiv and fibre. The goal is to empower UK farmers to integrate hemp and flax within their rotations, contributing to a diversified income stream while supplying construction, textiles, and renewable energy markets with low-carbon alternatives.

The future of fibre crops lies in our ability to quantify, validate, and communicate their environmental benefits. Through the CHCx3 initiative, Unyte Hemp is dedicated to transforming UK agriculture, embedding sustainable practices, and unlocking the full carbon-capturing potential of hemp and flax.

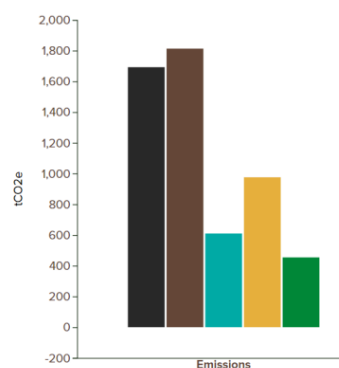


Farm Carbon Toolkit

Carbon calculator

In the project, [Farm Carbon Toolkit](#) is developing tools to enable farmers and growers to more accurately estimate changes in their farmland carbon stocks within our existing Farm Carbon Calculator, especially when growing high carbon capture crops. We are also conducting the carbon baselining of the trial sites in the project. For the project partners, we have developed a soil sampling protocol and are collating all the carbon data for the project.

Expanding the Carbon Calculator to Include Biomass Crops



In October 2024, we updated the calculator to include biomass crops, enabling more accurate assessments for biomaterial, biofuel and biomass systems. The newly added crops—short rotation coppice (willow and poplar), miscanthus, switchgrass, and hemp—allow farmers to comprehensively account for all emissions sources. This is crucial in the biofuels and biomaterials sectors, where green claims face growing scrutiny. Ongoing updates to the Calculator will be done over the course of the project using the research and findings of above and below ground carbon in crop biomass from routine soil analysis.

Graph is example of emissions report that enables you to compare your reports taken from [Quick start guide Nov 2024](#).

Understanding Emissions from Biomass Crops

Previously, biomass crops were excluded due to the complexity of calculating emissions from plant residue decomposition. When residues such as straw, leaf litter, or roots decompose, they release nitrogen, which can convert into nitrous oxide (N₂O), a potent greenhouse gas. N₂O emissions depend on factors like nitrogen content of the plant material, how much of the material is left in the field after harvest, and what fractions of above and below-ground material (i.e. leaf litter or roots) are available for decomposition annually. While the UK's annual greenhouse gas inventory provides some of this data, collaboration with industry professionals and FCT advisors was essential to address gaps and calculate emissions factors for biomass crops.

Tackling Challenges of Perennial Crops

Perennial crops like miscanthus add complexity to emissions calculations. Each year, miscanthus regrows 3–4 metres of above-ground material, with leftover litter decomposing annually. However, its below-ground rootstocks remain productive for over 20 years, meaning minimal decomposition occurs yearly as most nitrogen stays locked in living roots. To estimate emissions, we calculate how much below-ground material decomposes annually versus how much remains active. We also factor in the crop's productive lifespan, as the entire root system will eventually decompose and contribute to long-term emissions.

Providing Robust Emissions Data

With input from industry experts, growers, and farm advisors, we've developed reliable emissions factors for biomass crops tailored to UK farming conditions. These updates ensure farmers can effectively measure and manage emissions from biomass dependent systems. Enhancing the Carbon Calculator allows us to empower farmers to adopt sustainable practices and contribute to a greener future.

News From the Hub

What we have been up to

The project partners have been extremely busy this autumn and winter!



Cover crop open day

In mid-October, we spent a day in the field looking at this year's cover crop trial at Morley. We had a great deal of interest in the components of the mixtures and a brilliant talk from Liz Bowles, Farm Carbon Toolkit CEO.

Visit to IndiNature

At the end of October, the CHCx3 team visited IndiNature's Processing factory to learn about how hemp and flax go from retted fibres to insulation products.



Agri-TechE day

Early November marked Agri-TechE week. As a part of this, CHCx3 hosted an event which focused on 'Can regenerative agriculture get us a step closer to Net Zero?'. Talks varied on topics from soil carbon to waste valorisation.

CropTec

Project Lead, Dr Lydia Smith gave an excellent talk at CropTec at the end of November on hemp and its diverse applications.



Potential of biobased insulation materials

A recently-published review and categorisation of the climate mitigation potential of 174 biobased insulation materials has highlighted that the embodied carbon values of most bio-based insulation materials compared favourably to glass wool, benefiting from the stored carbon in the biomaterials. However, their physical and environmental properties were variable, with areas for improvement in embodied energy and thermal conductivity. The 174 materials and products mapped involved 39 distinct bio-based materials, either in their raw form or combined with 40 binders from a range of material groups including biopolymers. Hemp, flax and miscanthus were amongst the bio-materials, with hemp and flax showing potential to outperform the best embodied energy value of glass wool when using less energy-intensive binders.

- Zheng Lu, Michael Hauschild, Lisbeth M. Ottosen, Teklit Gebregiorgis Ambaye, Pierluigi Zerbino, Davide Aloini, Ana T. Lima. Climate mitigation potential of biobased insulation materials: A comprehensive review and categorization. Journal of Cleaner Production, Volume 470, 2024, 143356 <https://doi.org/10.1016/j.jclepro.2024.143356>

Opportunities for farmers from industrial hemp growing

An [article](#) published by Farmers Weekly has highlighted the potential for industrial hemp to boost carbon capture, improve soil health, mitigate weather impacts, support biodiversity and enhance following crop yields. The high-value natural fibre it produces is well suited to domestic markets as well as export opportunities, with increasing demand for use within construction, insulation and vehicle manufacture, where the potential to combine natural fibre with carbon fibre to reduce shattering is of particular interest within motorsport. To be economically viable on farm, there needs to be a market for all parts of the crop plant once processed. The article highlights ongoing work by researchers, breeders, growers, processors and end users within CHCx3 to further develop the hemp value chain.



Hemp being cut and harvested—Jasmine Toole, Niab

Meet the CHCx3 Partners

Kevin Lindegaard

Crops4Energy

Back in 1993, I got a casual summer job at Long Ashton Research Station in Bristol. Even though I had a BSc in Environmental Biology, I wasn't that familiar with the concept of biomass and probably couldn't identify any willow tree except a weeping one. On that day I was introduced to a concept that would steer the course of my professional life. The idea of planting fast growing trees to help tackle climate change sounded like a great idea. I believed that then and I believe it now. It's a shame that 30 years later the concept has still yet to become part of mainstream agriculture.

Achieving that goal has become my life's work. I have been a willow breeder, worked with power stations and as the renewable energy officer at Dorset County Council. For 20 years I have been running [Crops for Energy](#) – a consultancy that provides advice on every aspect of the supply chain. These days I say that my interests lie "Beyond Bioenergy". I love the fact that these crops can play a part in both climate change adaptation and mitigation by providing many environmental applications whilst they are growing (e.g. flood mitigation, carbon sequestration, buffer strips etc) and produce a diverse range of sustainable biomaterials for all sorts of end uses.

If the UK is to upscale a tiny, nascent industry and make up for lost ground, we need landowners to be able to make agile decisions based on up to date, independent information. This is where the idea for Envirocrops was born. I have written hundreds of reports as a consultant. However, these represent valid information at the point they are presented to the client. With the Envirocrops project we are building a digital consultant that benefits from all the technology we take for granted in modern living-price comparison, digital directory and marketplace, AI chat functionality, an interactive STEM game. Furthermore, Envirocrops will act like a very refined search engine getting people to the information they need and helping everyone along the supply chain.

As the CHCx3 project starts producing results will begin adding them to the portal and Envirocrops will grow. It's particularly exciting to be working alongside Farm Carbon Toolkit as both of these tools will benefit from the others knowledge and put that into the hands of farmers.



Nathaniel Loxley and Rebekah Shaman

British Hemp Alliance

The [British Hemp Alliance](#) (BHA) is at the forefront of transforming the potential of industrial hemp into tangible benefits for farmers, industries, and the planet. We are an organisation that is committed to building a fair and sustainable domestic value chain for industrial hemp, driving research, innovation, and collaboration across the sector.

For decades, industrial hemp was burdened by stigma, restrictive laws, and widespread misunderstanding. But times are changing. With growing recognition from both government and industry, this remarkable crop is finally receiving the attention it deserves. Hemp is not just a crop—it's a regenerative powerhouse with the ability to store carbon, enrich ecosystems, and offer groundbreaking solutions for climate mitigation.

At the BHA, we've been advocating for this shift for years, championing the ecological and social benefits of hemp. Through lobbying, stakeholder engagement, and participation in initiatives like the CHCx3 project, we are paving the way for research, innovation, and large-scale adoption. We are proud to support British farmers and the bioeconomy by bridging gaps in knowledge, connecting stakeholders, and building a thriving, resilient ecosystem.

The global momentum around hemp is undeniable. Domestically and internationally, industrial hemp is being recognised for its role in carbon removal and long-term storage within biomaterials like construction products. By storing biogenic carbon for over 100 years, materials like biochar and hempcrete are not only reducing emissions but also creating opportunities for carbon removal credits—a crucial step toward decarbonising industries and achieving climate goals.

Although we are a small organisation, our impact is significant. We provide invaluable resources to farmers, industry partners, international organisations, and marketplaces that share our vision for an ecologically rich and sustainable supply chain. With society's mindset shifting and progress accelerating, we are here to guide, inform, and empower stakeholders in this movement.

Scientific tools like life cycle assessments and environmental product declarations are essential for building trust in these emerging products and processes. While the journey has been slow at times, the progress we've seen in the past decade is a testament to the power of persistence and collaboration. Industrial hemp is more than just a crop—it's a catalyst for change, and the BHA is proud to be part of this transformative journey. Together, we can create a prosperous, sustainable future for British agriculture and the global bioeconomy.





In the Field

Mark Spendlove

Herbal ley grower, Northamptonshire



Size: 500 acres

Soil Type: iron stone to a medium clay loam

Mark Spendlove grows herbal leys to produce good quality grazing and silage and to reduce overheads. His farm is 'traditional mixed. We grow grain, graze sheep and keep a suckler herd of 100 cows, crossed with Hereford bulls, to produce supermarket spec cattle. 'I say to folks, we're newcomers, we've only been up here 75 years,' quips Mark. We are both farmers and custodians of the land.'

Mark explains the drivers for herbal leys...

'We're in a very dry area, we have to manage with just eighteen inches of rainfall per year. Traditionally, we were growing ryegrass mixtures with clover. The old adage says that 50% of your grass will have grown by the end of May and that's when the clover gets up and gets away. But with the lack of rain, and ryegrasses being shallow rooted, the ley tailed off after the first cut. Then complex herbal leys became available, and we haven't turned back.'

'Originally the herbal leys included a proportion of ryegrass along with a range of other species, but as we have fine-tuned the mixes we have reduced the ryegrass and opted for timothy, cocksfoot and festuloliums which are deeper rooting for reaching moisture. The clovers are providing the protein, and the chicory is very deep rooting for making drainage channels, along with plenty of earth worm activity. In the dry season, the leys are still green. Everything does a job.'

Mark has seen their need for nitrogen fertiliser drop off massively. 'The leys are fixing their own nitrogen, and the residue that's left over helps to grow the next cash crop. So there's a double win. The other benefit is keeping the feed lorries away because we're now producing 95% of our feed. The leys are brilliant for fattening lambs. My son in-law and daughter are selling finished lambs, 50kg plus, with absolutely no purchased feed; it's purely this aftermath grazing.'

'The seed isn't cheap compared to ryegrass-based mixes, but you're saving on nitrogen, and thanks to new SFI schemes in England we're now being paid to grow these mixes which is yet another bonus. Though farmers absolutely need the subsidies, the leys would stand up on their own. We're producing food, looking after wildlife, looking after the soil, and we're paid to do it. What's not to like?'

Mark prefers to establish the leys in spring. 'We've tried autumn, but clovers can be slow and less reliable if we do not have an open autumn. When it comes to machinery for establishment, Mark keeps things simple.

'A reliable establishment is key; we have a very simple tine drill with leading discs. We either use it for direct drilling when the conditions are right or as a seed broadcaster when we've had to make a seed bed. We basically just dribble it on the surface and the chains on the back work it into the ground. It's essential to roll it, probably twice.

'For cutting duties we operate a mower that has a rubber roller conditioner on the back which crimps the stem to let the moisture out. We don't use a tedder to move the crop because the machine will knock it about too much; you'll get leaf shatter and lose the protein. We pick the grass up with a self-loading forage wagon. The silage is destined for the pit and the speed at which we can clamp is what governs the speed of the operation. We use an additive to help with stability and improve fermentation because the silage can be sappy and higher in moisture than grass only mixtures.



Mark typically leaves leys in the ground for four years. In terms of management, he advises 'Give the ley a chance and be patient. Don't leave cattle on for a prolonged period and certainly not in wet weather. You'll be able to fatten lambs on it. There is talk about the clovers affecting the oestrogen cycling of ewes, so just be a little wary of that. Production in year one can take a while, especially from a spring sowing, you could top it to help tiller it out. Then next year you'll comfortably get three mowings of silage off of it.'

Mark uses Cotswold Seeds 'because they have been specialising in complex mixes for 50 years. I just ring up Sam and leave it to him to pick the varieties of grass, legumes and herbs that are going to suit our land. He knows us and the farm. I can't fault them.'

Get Involved

Contact us at chcx3@niab.com

Visit our web pages carboncapturecropping.com

Find out more from one of the CHCx3 Partners:

[NIAB](#), [Biorenewables Development Centre](#), [Bitrez](#), [British Hemp Alliance](#), [Cotswold Seeds](#), [Crops for Energy](#), [Elsoms Seeds](#), [Energy Crops Consultancy](#), [Farm Carbon Toolkit](#), [FarmED](#), [F C Palmer & Sons](#), [National Farmers Union of England & Wales \(NFU\)](#), [Natural Building Systems](#), [Northern Ireland Hemp Association](#), [Rothamsted Research](#), [Terravesta](#), [UK Hempcrete](#), [University of York](#), [Unyte Hemp](#)

Forthcoming Events

Date and Time	Event	Location
15/01/2025 13.00—14.00	<u>Fibre crop processing webinar</u>	Zoom Webinar
26/02/25 Day event	<u>Miscanthus Open day</u>	Hackthorn, Lincoln

Catch up on previous events

Date	Event	Location
11/09/24	<u>Harmonisation of Carbon Accounting Tools for Agriculture</u>	Webinar—1hr
13/11/24	<u>Getting to grips with soil carbon</u>	Webinar—1hr
11/12/24	<u>Herbal leys and diverse swards</u>	Webinar—1hr

Acknowledgements

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