

The logo for The Carbon Farm, featuring a stylized green hexagon with a white outline and a green interior, set against a dark green background.

THE CARBON FARM

HEMP CULTIVATION | SOIL REGENERATION

Case Study

Agronomic Insights into Industrial Hemp: Cultivated with the Principles of Regenerative Agriculture.

Executive Summary

The Carbon Farm is a research-driven company with five years of specialised experience in cultivating regenerative industrial hemp. Through innovative techniques, collaboration with experts and bold experimentation: we have built a unique knowledge base in this promising field. This case study showcases our agronomic decision making, research and learning points, and, highlights our ongoing commitment to furthering development into hems profound agronomic and industrial properties.

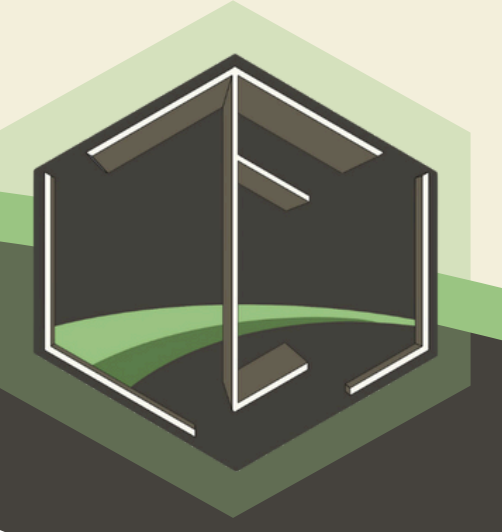
The Carbon Farm's work demonstrates the immense potential of hemp. By studying traditional techniques, connecting with experts and embracing regeneration: we aim to bridge gaps in understanding how to make hemp an accessible and profitable crop.

Purpose of this case study

The Carbon Farm is uniquely positioned to dispel misconceptions, integrate hemp into food rotations, rejuvenate soil and supply industry with sustainable raw materials. This study showcases our agronomic development, our approach to decision making within the regenerative mindset, and, the experience we have gained: allowing farms to see how simple hems integration into their food rotations can be.

Company milestones

- 2018: Research into the history, culture, and agronomy of industrial hemp.
- 2019: Company established; planning for the 2020 season began.
- 2020: Cultivated 8 acres of hemp; initiated biochar testing with the University of York.
- 2021: Conducted R&D into biochar, pulping, and secondary raw material processing. Planning for 2023 season began.
- 2022: Cultivated 10 acres of hemp, and, connected with subject matter experts.
- 2023: Explored the UK and European hemp markets and expanded education in regenerative farming.
- 2024: Launched a strategy to expand hemp's market viability and industrial adoption; collaborating with international enterprises, world leading brands and national education bodies in regenerative agriculture.



Growing season 2020 timeline.

8th April, 2020

The land we secured, an 8-acre plot, had been impacted by a Category 4 storm earlier in February leaving it partially flooded. Unharvested potatoes remained scattered across the field.



18th April, 2020

Muck spread. 20mm grade organic compost at three tonnes to the acre.

26th April, 2020

2 harrow passes, perpendicular to each other. To terminate the potato crops and seeds.





10th May, 2020

Future 75 seed arrived from France.

23rd May, 2020

Drilled. Futura 75 industrial hemp. 60kg/ha seed drill rate at 7 inch rows.



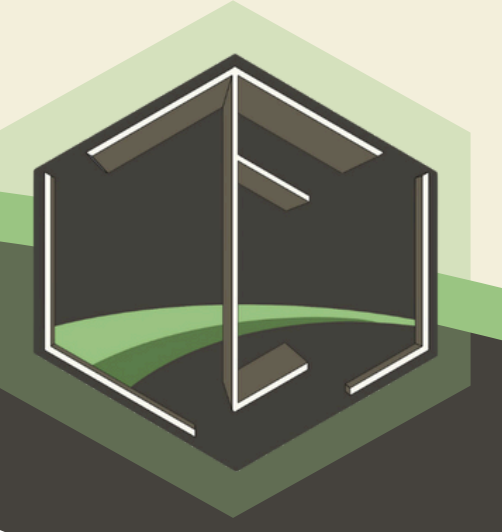
24th May, 2020

Seed emergence

29th May, 2020

Irrigation pass, applying 50mm of water to prevent heat stress in 30°C+ temperatures on bare soil.





4th June, 2020

Seedlings 60mm high, potatoes sporadically germinating at ~150mm high.

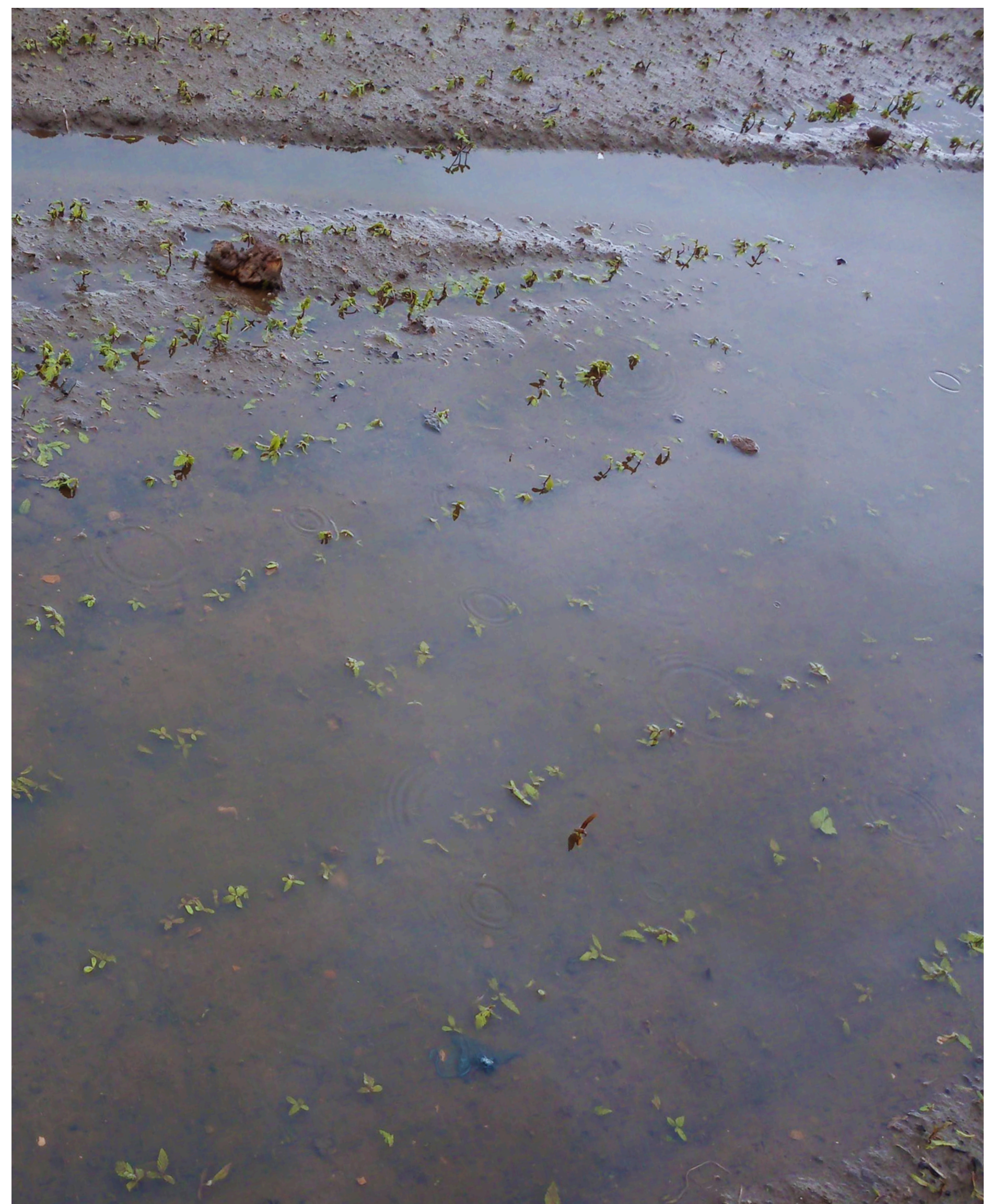


5th June, 2020

Heavy rain, flooding.

7th June, 2020

Hail stones causing crop damage and more heavy rain.





13th June, 2020

Crop recovered well, back to ~60mm high.



21st June, 2020

~150mm high, matching the height of the potato crop in the same field. *Figure 1*

29th June, 2020

crop ~350mm high. *Figure 2*





5th July, 2020

Up to 500mm high, now canopying potatoes.



12th July, 2020

Crop up to 1 metre tall. *Figure 3*

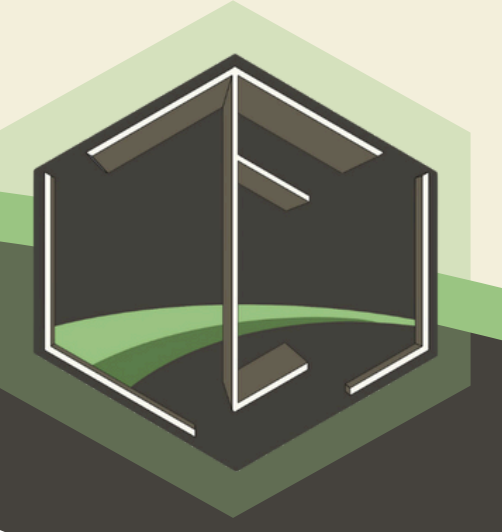
25th July, 2020

Crop now up to ~1.8m. *Figure 4*

5th August, 2020

Hemp plant moving into seed reproductive stage (seed production). *Figure 5*





10th August, 2020

Hemp ready to cut. maximum height achieved ~2m.



12th August, 2020

Cut using a three-tiered side cutter, with blades set at 100mm, 1 meter, and 1.5 meters from the ground. Left in the field for retting.



19th August, 2020

Grass rake/tedding pass.

26th August, 2020

Windrow and bale.

30th August, 2020

Straw was sent to the BDC University of York Centre for research and development into our hemp biochar project. Additionally, 25% of the straw was retained for internal R&D, while 75% was sold as straw.



2020 season evaluation

In our first season we drilled around 6 weeks later than preferred which forced us to harvest earlier in the crops growth cycle; late acquisition of land was a key factor in this. The land had been heavily dependent on synthetic nitrogen fertiliser and had no cover crop growing over the winter seasons. Instead of applying zero synthetic nitrogen, in hindsight, 30% of the previous application rate would have improved our yield. This would, however, have slowed the regeneration of the land: a trade off worth considering if maximum yield was needed.

2020 marked the first season of industrial hemp cultivation for the company. We learnt exactly how a typical industrial hemp season plays out: including machinery, contractors, costings and timings. Through analysis we were able to see where we went wrong and where we could learn from.

To improve in our second season: a cover crop would be needed to continue soil regeneration during the winter season. No irrigation would be needed as the cover crop would lower the surface temperature in seedling stage, it would also significantly lower nutrition requirements. Drilling timings should have occurred 4-6 weeks earlier, therefore, land acquisition should be no later than September in time for the winter season cover crop to attain these benefits.

We achieved 4.32t/ha (slightly below our benchmark) and we had very good crop health. Given the less than ideal start: the crop was a success, profitable and provided hands-on insight into a typical hemp season.

Given that we only leased the land for one season, synthetic fertiliser was applied after us by the farm in order to grow Cabbage. Although they reported their yield that year was noticeably higher than expected, it is not substantive to warrant as evidence that our hemp crop was the cause of this increase. Furthermore, technology was not readily available at this time for SOC analysis, therefore, in-depth soil health analysis was unachievable and too expensive for us to explore.

2022 season evaluation

This seasons cultivation presented itself with renewed and different challenges. By taking the experience gained in 2020 and the theoretical knowledge learnt in 2021; 2022 saw us grow 10 acres of hemp on an expanded plot of land. We were perfectly positioned to plant specific cover crops for particular functions to gain their nutritional and protective advantages for the following season. Subsequently, we drilled a 3 species cover crop which consisted of Hairy Vetch, Ryegrass and Crimson Clover. The cover crop established well and kept the nutrients cycling in our system ready for our hemp to benefit from.



We spread organic compost fertiliser at 10t/ac: around three times that of our 2020 season. We topped the cover crop in March 2022 and drilled on April 15th 2022 into the cover crop. This was a timings error and the cover crop had regrown since topping and stood around 200mm high. Topping the cover crop was not in our plan; we intended for livestock to graze the cover crop, yet, it was not able to be arranged in time and topping was the only option available to us. We should, however, have mowed the cover crop closer to drilling.

The hemp crop struggled to gain establishment in some areas and in other areas never grew more than 600mm high. It did, however, gain dominance in places and canopied over the cover crop which terminated any competition (figure 6 & 7).



Harvested 20th August, variability in height from 600mm- 2.2m. Crop health was good but complications with European seed acquisition and cover crop termination lead to a poor start to our season and subsequently affected harvest. Still, however, yielding 4.8t/ha of straw biomass.

FYM (Farm yard manure) should also have been incorporated for better organic matter/humus content in the fertiliser and ideally animal integration would have been planned to give these benefits with increased profitability.

2025 season plan

Recognising our need for expert guidance in regenerative farming early on, we have partnered with one of the UK's leading education programs. Through this collaboration and our integration into this emerging scientific community, we've bridged knowledge gaps to refine agronomic decisions towards soil health, resilience and away from mechanistic yield. Our commitment to R&D drives our 2025 growth plan, which includes 30 acres dedicated to complex regenerative theories: advancing profitable, pioneering sustainable hemp cultivation.



Bibliography

1. Measuring the Transition to Regenerative Agriculture in the UK

- Summary: Co-designed experiments evaluate the effects of regenerative agriculture on soil health, biodiversity and crop quality. The study provides insights for UK agricultural policy.
- Significance: Offers quantitative evidence to support regenerative farming as an approach for environmental and agricultural sustainability.
- Access: [White Rose Research Online](#)

2. Barriers and Enablers to Agroecological and Regenerative Farming Adoption

- Summary: Explores the financial, knowledge-based and regulatory challenges to adopting regenerative agriculture in the UK: with recommendations in overcoming these barriers.
- Significance: Provides a roadmap for stakeholders and policymakers to foster the adoption of sustainable farming practices.
- Access: [NERC Open Research Archive](#)

3. Transformations to Regenerative Food Systems: Policy Implications

- Summary: Investigates how regenerative agriculture can reshape food systems to address climate change, enhance biodiversity and support sustainability goals.
- Significance: Offers actionable recommendations to embed regenerative practices within UK food and agricultural policy frameworks.
- Access: [NERC Open Research Archive](#)

4. Can Regenerative Agriculture Increase Soil Organic Carbon Without Yield Loss?

- Summary: Examines the potential of regenerative farming practices to increase soil organic carbon while maintaining agricultural productivity.
- Significance: Demonstrates the compatibility of climate mitigation efforts with food security goals.
- Access: [Science of the Total Environment](#)

5. Roadmap Plan to Boost UK Industrial Hemp Production and Processing

- Summary: The HEMP-30 project outlines a strategy to expand UK hemp cultivation for sustainable applications including food, construction, and bioplastics, while improving traits like drought resistance.
- Significance: Positions industrial hemp as a key crop for environmental sustainability and economic growth.
- Access: [University of York](#)

6. The Role of Hemp in Bioplastics and Renewable Materials

- Summary: Highlights the application of industrial hemp in creating renewable materials for industries like automotive and aerospace, reducing dependency on petrochemical-based inputs.
- Significance: Advocates for hemp's versatility and its role in a circular economy focused on sustainability.
- Access: [Biorenewables Development Centre](#); University of York



As industrial hemp cultivators dedicated to regenerative agriculture, we aim to advance sustainable practices that benefit the environment and communities. For questions or collaborations, contact us at:

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Together, we can harness the power of hemp and regenerative farming for a sustainable future.

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