Building Based on Biobased

BBoBB- Webinar III

Hemp Cultivation in Germany and Denmark

- economic, environmental and climate potentials

Interreg North Sea

Co-funded by the European Union

BBOBB

Welcome

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Agrovi
Den bedste løsning på jorden

Source: https://hanfstein.schoenthaler.com/de, https://bilderpool.fnr.de/

Structure

1. BBoBB Building Based on Biobased – short introduction
2. About 3N
3. Hemp Cultivation in the EU and Germany
    1. Statistics
    2. Legal framework
    3. CO_2 Storage
    4. Economic view
4. Building with Hemp in Germany
    1. Big player
    2. CO_2 Storage in Buildings
    3. Economic view

1. BBoBB – Short introduction

- 16 partners from 5 countries in Northern Europe working together in BBoBB
- Main target: design, develop and strengthen value chains for the use of biobased materials
- Focus on 4 crops: Hemp, Flax, Miscanthus and wet crops (e.g. Cattail)
- Use of biobased materials in building sector offers unique opportunity for reaching climate goals:
  - Store CO_2 instead of emitting it
  - new business models for farmers
  - soil health
  - biodiversity

BBoBB
Building Based On BioBased

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Learn more about our project:

https://www.interregnorthsea.eu/bbobb and follow on LinkedIn

About 3N – competence center for renewable resources and bioeconomy e.V.

Founded 2003 in Werlte

3 offices in Lower Saxony

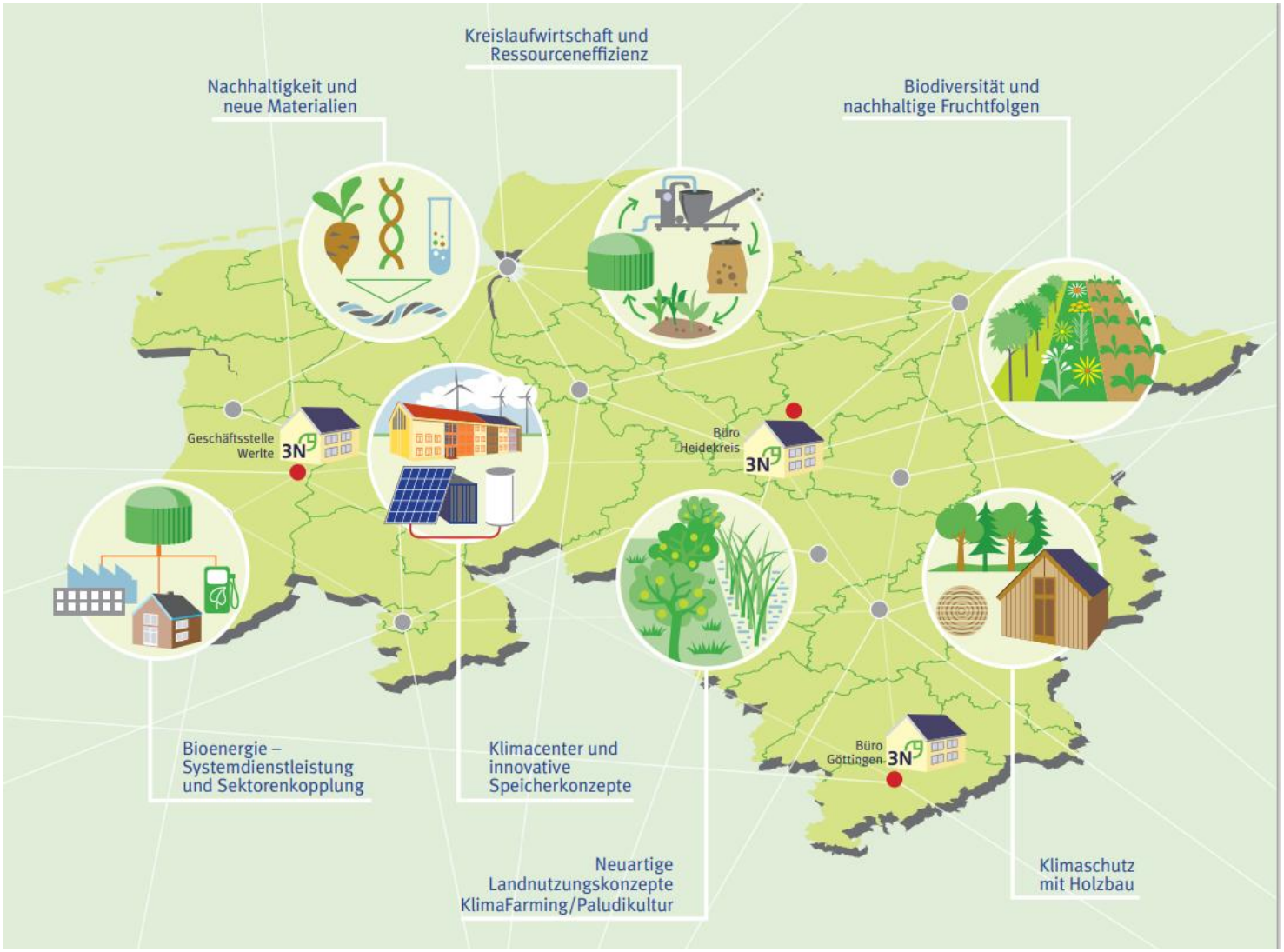
>25 employees

>20 projects

Focus on

- **Renewable resources**
- **Innovative and sustainable landuse**
- **New materials (e.g. bioplastics)**
- **Circulair economy**

→ bioeconomic approach

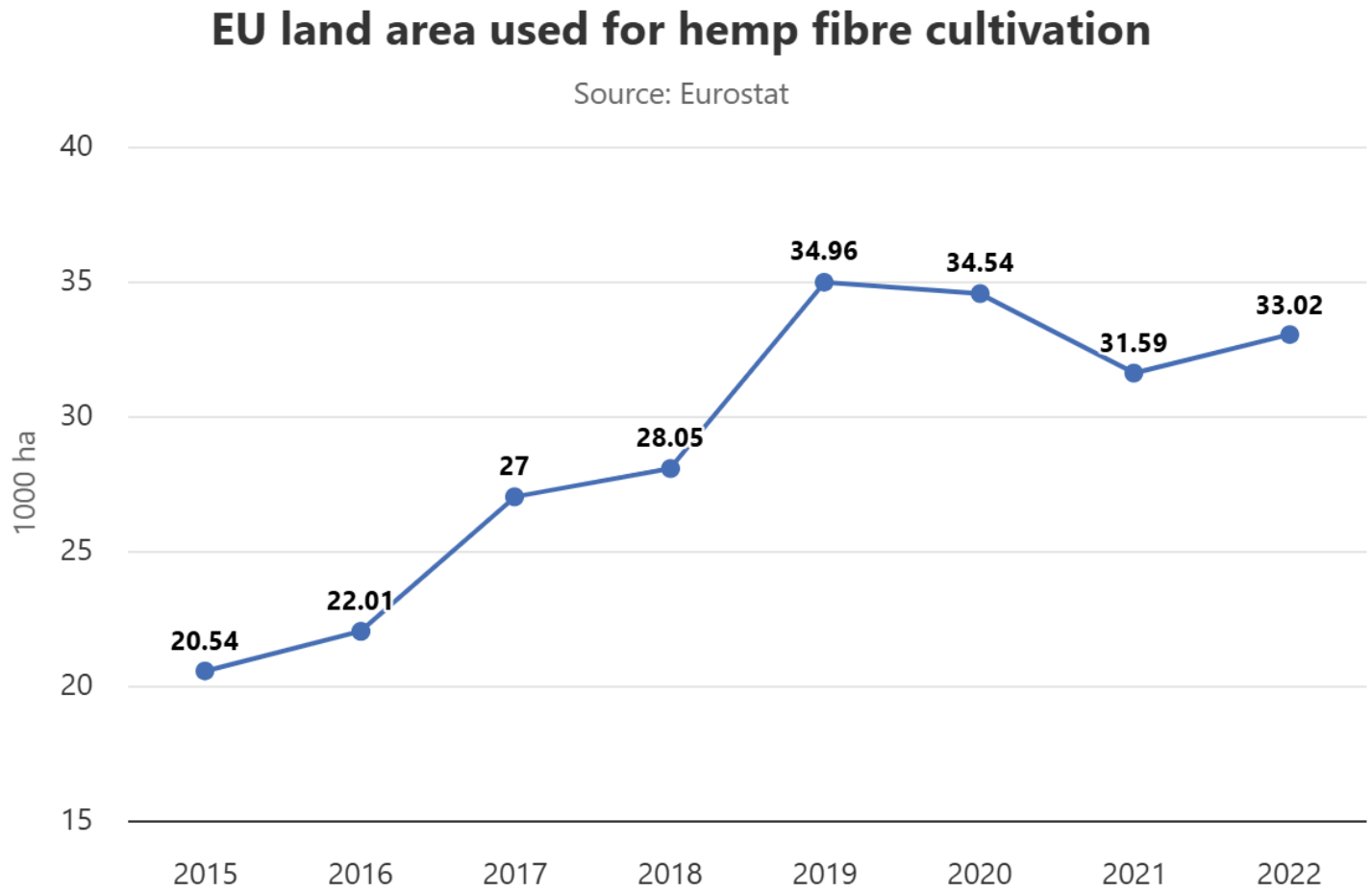


Hemp Cultivation in the EU and Germany

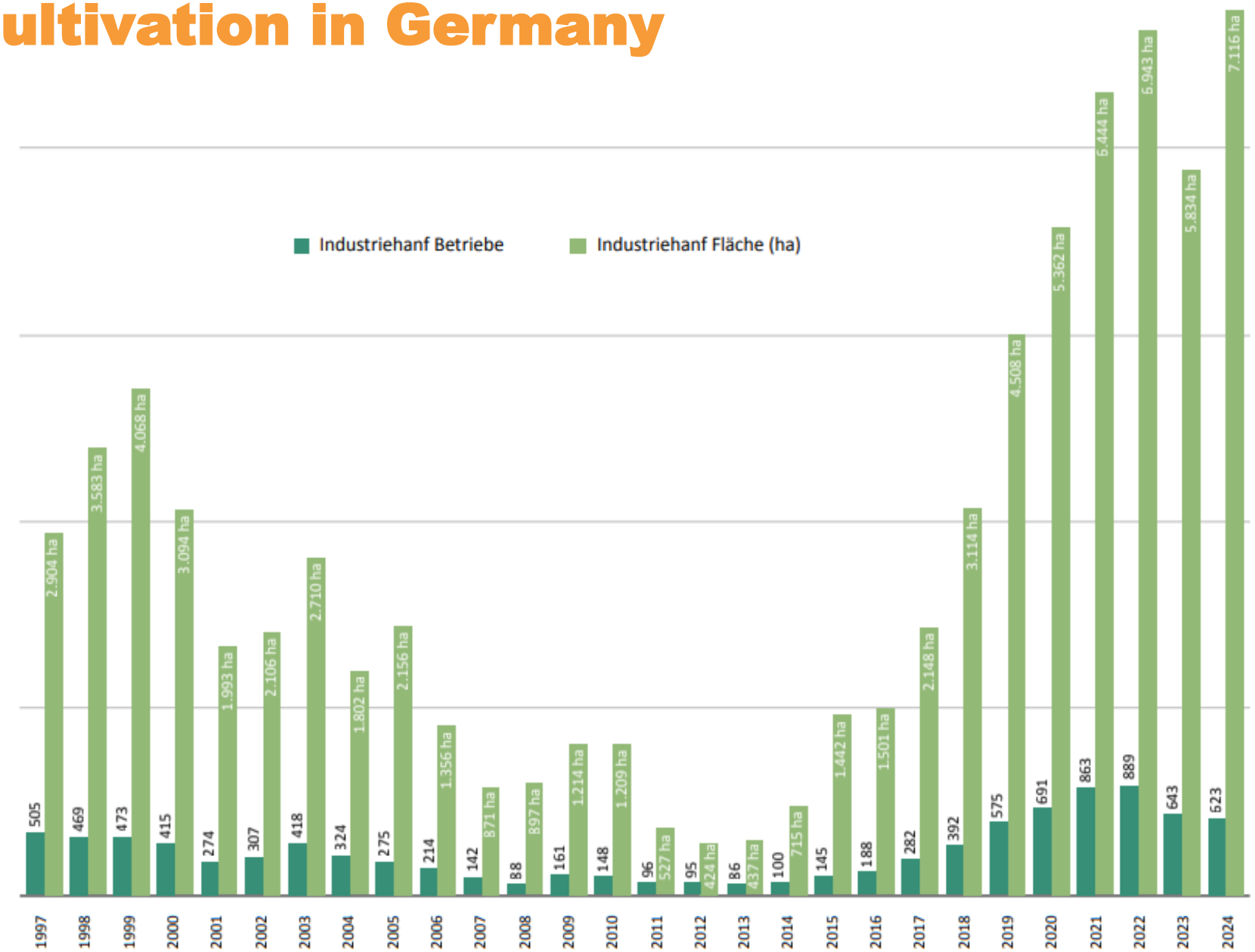
Hemp cultivation in the EU

France is the largest producer, accounting for more than 60% of EU production, followed by Germany (17%)

The Netherlands, Italy, Italy, Lithuania, Poland, Austria are also important growing countries



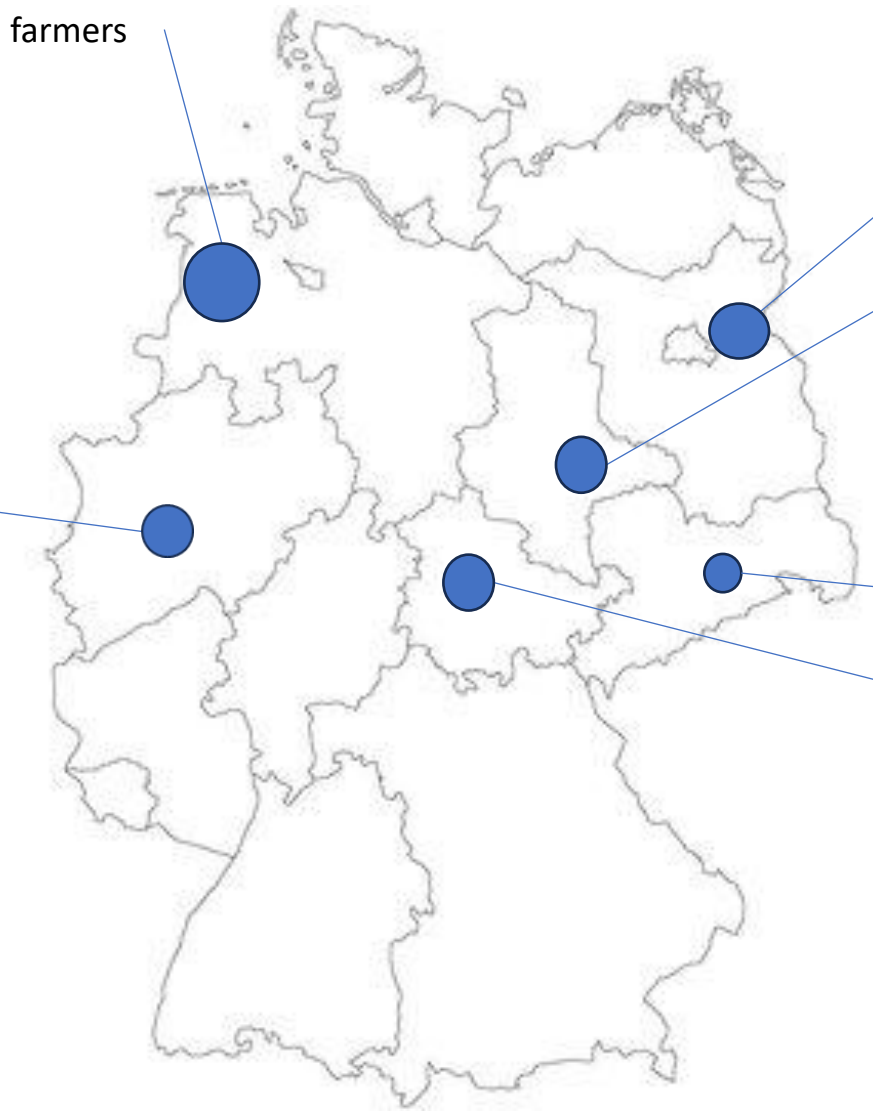
Hemp cultivation in Germany



2025

2. Hemp cultivation in Germany in 2024

Lower Saxony: 1.478 ha / 131 farmers



Brandenburg: 892 ha/ 32 farmers

Sachsen-Anhalt: 787 ha / 21 farmers

NRW: 467 ha / 68 farmers

Sachsen: 345 ha / 22 farmers

Thüringen: 542 ha / 25 farmers

Source: Bundesanstalt für Landwirtschaft und Ernährung (BLE): Informationen zum Thema Nutzhanf.

Verfügbar unter: https://www.ble.de/DE/Themen/Landwirtschaft/Nutzhanf/nutzhanf_node.html

Hemp cultivation in Germany
Requirements

Requirements for cultivation:

- Resilient plant without special requirements
- Deep and humus-rich soils show best results
- sowing temperature at least 5-10 °C
- Needs Frost-free period (120–150 days).
- Optimal temperature for growth: 15–27 °C.
- High light intensity for fiber production

Source: pixabay.de

Industrial Hemp as a CO_2 Storage

One tonne of harvested hemp stem contains

0.7 tonnes of cellulose (45% carbon),

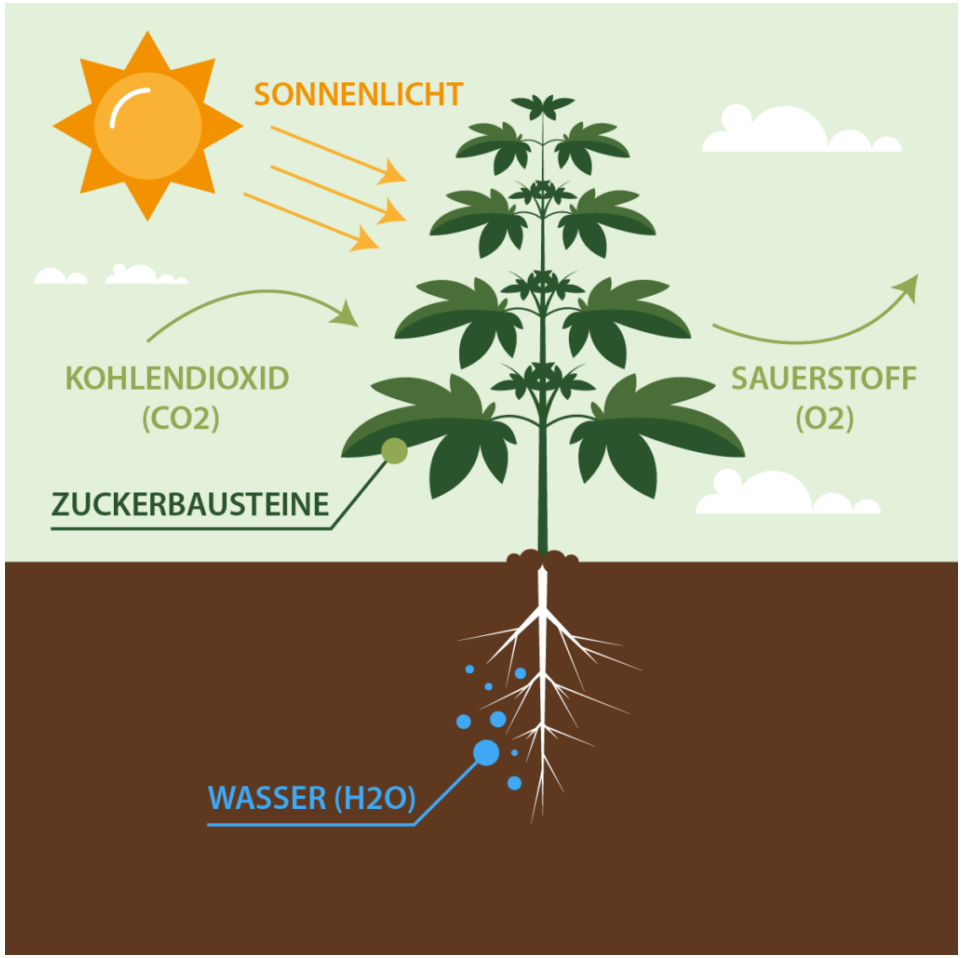
0.22 tonnes of hemicellulose (48% carbon)

0.06 tonnes of lignin (40% carbon).

= 0.445 tonnes carbon absorbed from the atmosphere (44.46% of stem dry weight).

→ Converting carbon to CO_2 (12 t of C equals 44 t of CO_2), this represents 1.6 tonnes of CO2 absorption per tonne of hemp.

→ On a land use basis, using a yield average of 5.5 to 8 t/ha represents 9 to 13 tonnes of CO_2 absorption per hectare harvested.



Source: European Industrial Hemp Association (EIHA)

Remember:

- Hemp can be grown twice a year (winter/cover crop & main crop)

→ doubling its CO_2 absorption.

- Fast growing: 4 meters in 100 days

→ more efficient than agroforestry

European Green Deal:

Improving energy efficiency in the building sector will play a key role in achieving carbon-neutrality by 2050

Hemp can play a significant role in reaching this objective.

Hemp cultivation – economic view

No systematic data on the economic viability of industrial hemp cultivation

No established markets with transparent price information

Vertical integrated companies or cooperative

→ organize processing and marketing

Free marketing after harvesting is hardly possible

Economic efficiency calculation

Calculated by

von Thünen Institut in 2019

expert interviews with hemp-growing farms

Calculation should be considered as rough estimates

	Einheit	Only seed harvest	seed and straw harvest	wheat cultivation
Straw yield	t/ha	-	6,5	-
Straw price	€/t	-	115	-
Grains/seed yield	t/ha	1,3	0,6	7,5
Grains/seed price	€/t	800	800	160
revenue	**€/ha**	**1.040**	**1.228**	**1.200**
Seed requirements	kg/ha	40	50	-
Seed price	€/kg	10	6	-
seed	€/ha	400	275	70
Fertiliser	€/ha	37	199	193
Plant protection	€/ha	-	-	160
Total direct costs	€/ha	437	474	423
Direktkostenfreie Leistungen	**€/ha**	**603**	**753**	**777**
labor costs	€/ha	322	631	378
Drying/cleaning	€/ha	29	13	56
Direkt- und Arbeitserledigungskostenfreie Leistungen	**€/ha**	**253**	**109**	**343**

Quelle: Thünen-Institut, 2019, LfL 2019

Building with hemp in Germany

Hemp cultivation: big player

Hanf Farm GmbH
800-1000 hectares of cultivated hemp; production will cease by the end of 2024 – no more processing

Lower Saxony: 1.478 ha / 131 farmers

Hanffaser Uckermark eG
400-500 hectares of cultivated hemp processed to semi-finished products and building materials

Brandenburg: 892 ha/ 32 farmers

Naturwerk Borken
Production in the Czech Republic
Products – Insulation mats and panels
– planned production in Bad Bentheim/Emsland (Lower Saxony)

Sachsen-Anhalt: 787 ha / 21 farmers

Hanffaser Geiseltal eG
Hanffaser Uckermark spin-off – financing successful – production starts at the end of 2025

NRW: 467 ha / 68 farmers

Sachsen: 345 ha / 22 farmers

Thüringen: 542 ha / 25 farmers

VOFA Vogtlandfaser
300 hectares of organic fiber hemp, 18 farmers
Products - hemp fibers and shives

Bayern:

ThermoHanf → HemKor
Recently acquired by Kingspan/Hempflax
Hemp cultivation in the Netherlands and Romania

Source: Bundesanstalt für Landwirtschaft und Ernährung (BLE): Informationen zum Thema Nutzhanf.

Verfügbar unter: https://www.ble.de/DE/Themen/Landwirtschaft/Nutzhanf/nutzhanf_node.html

Case Study: Hanffaser Uckermark

Operating since 1996

At the time of its founding, there was nothing.

No way to harvest hemp. No processing technology. No products. No market for any potential products.

Today, there is a hemp value chain in Brandenburg and beyond:

harvesting technology, processing technology and machinery, products, the technical manufacturing of the products, testing, approvals, standards, a market and market share, and many opportunities

Case Study: Hanffaser Uckermark

Hanffaser Uckermark eG is a flagship example of how industrial hemp can anchor a resilient, regional, circular, and cooperative-based bioeconomy.

Their model is not only sustainable and community-driven but also highly scalable and adaptable

Ideal for BBoBB's goals: design, develop and strengthen value chains for the use of biobased materials in the North Sea Region.

Replicable regional model for other areas, including North Sea Region (NSR) countries

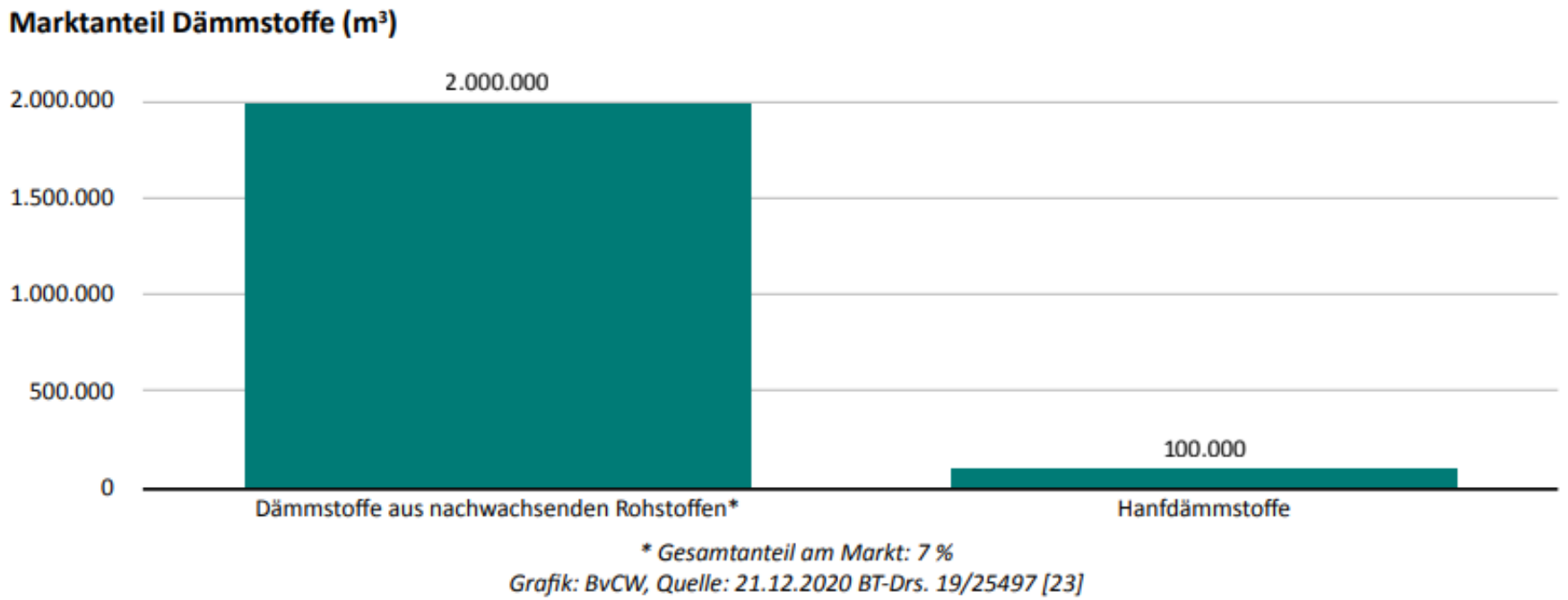
- → **Spin off Hanffaser Geiseltal proves scalability in both operations and cooperative governance.**
- → **Naturwerk Borken?**

Hemp based materials in building industry

Market share of insulation materials made from renewable raw materials in Germany (2019):

2 million m³ (mostly wood fiber) means 7 %in a total market of 28.4 million m³

Hemp insulation materials: 100,000 m³ → 0,35% of the total market



** Gesamtanteil am Markt: 7 %*

Grafik: BvCW, Quelle: 21.12.2020 BT-Drs. 19/25497 [23]

Case Study: Hemphouse as CO_2-storage

Built in 2022

Living space 124m²

Used Hemp materials:

lime, clay, shives, wool

Total built biomass: 15,3 t

Stored CO_2: 24,5 t

If hemp were cultivated for building material purposes on just 5% of arable land in Germany, 300,000 homes could be built with it annually.

Source: Henrik Pauly, Hanfingenieur

3. Building with hemp in Germany

A sustainably built house using hemp construction costs around 10-20% more compared to a conventional building.

Whether this additional effort is "worth it" depends on:

- **local construction costs,**
- **the availability of skilled tradespeople,**
- **funding programs,**
- **long-term energy savings,**
- **sustainability goals / resale value**

What is hindering growth?

Lack of knowledge among consumers, tradespeople, and architects

Lack of experience in building with hemp

Legal framework: warranties and guarantees

→ 3N Pilot addresses the lack of knowledge

3N Pilot

- exhibition is housed in a transportable wooden container
- offering visitors a hands-on experience of sustainable building

Thank you !

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Hemp Cultivation in Denmark

Status and potentials

Who we are

The Danish partnership in BBoBB

- Agrovi is a Danish agricultural consultancy firm providing advisory services to farmers
- Guldborgsund Municipality is a local government area in southeastern Denmark
- CELF (Center for Erhvervsrettede uddannelser Lolland-Falster) is a vocational education and training institution
- Business Lolland-Falster is a regional business development organisation

Agrovi

GULDBORGSUND

CELF

/ Business
Lolland-Falster

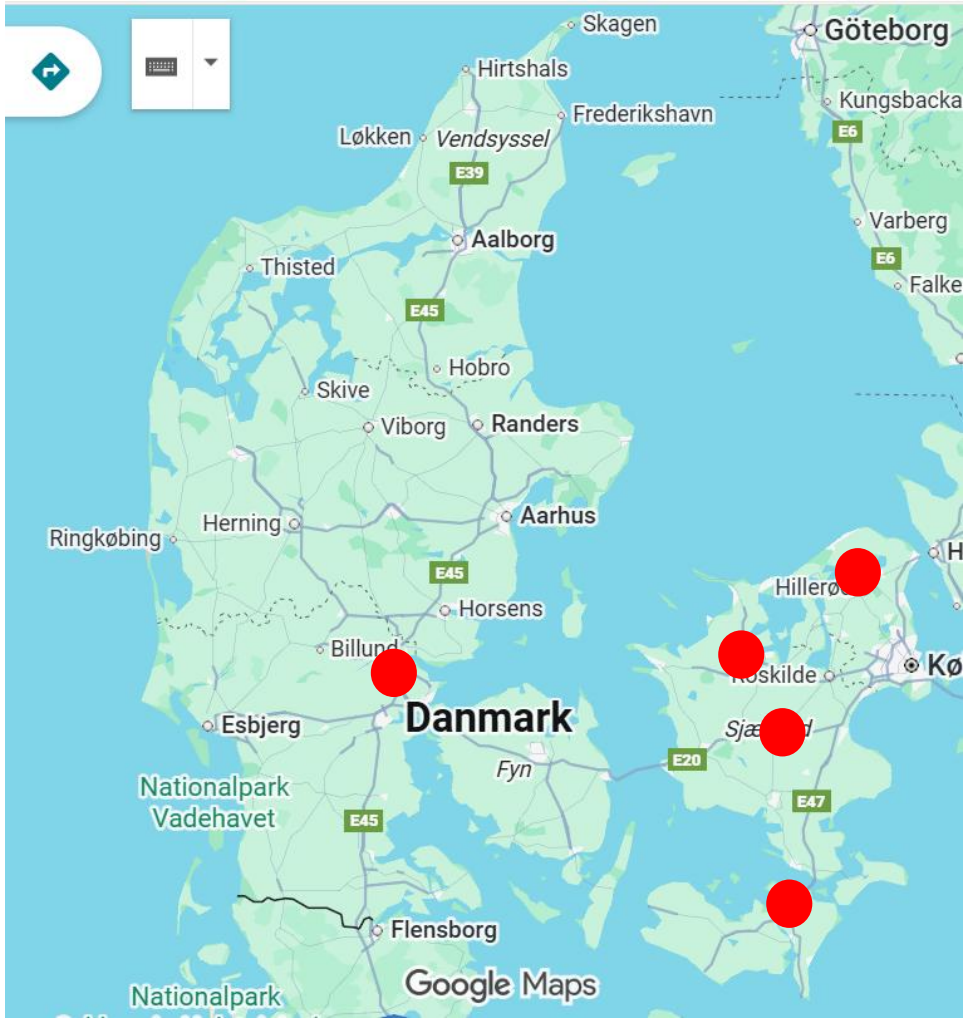
Who we are – Agrovi

Agrovi has five offices in Denmark: Hillerød, Ringsted, Holbæk, Nr. Alslev and Vejle

Besides offering consultancy, Agrovi works on several green transition projects, including BBoBB.

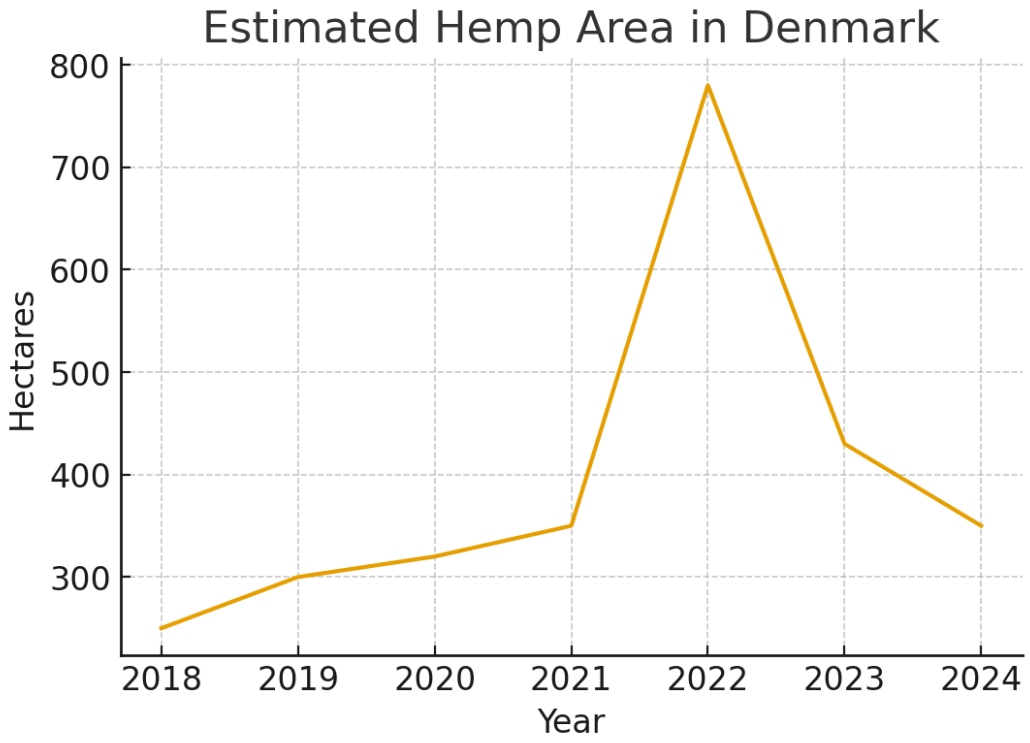
In this project, Agrovi focuses on the potential for growing industrial hemp for building materials and the wider environmental, climate, and biodiversity benefits it may bring.

Henrik Kruse Rasmussen
Project consultant, Agrovi



Status of hemp cultivation in Denmark:

- It is a niche crop with only a few hundred hectares cultivated nationwide each year
- Hemp in Denmark is mainly grown for seed production, which is used in food, feed, and cosmetics.
- Only a smaller share of the crop is cultivated for its fibres and for use in building materials.
- Cultivating industrial hemp requires a special permit. Farmers must apply for an authorization, which must be approved by the police before sowing.
- Only approved low-THC varieties may be grown (max. 0,2 %), and the crop is subject to control and documentation requirements



Status on value chain:

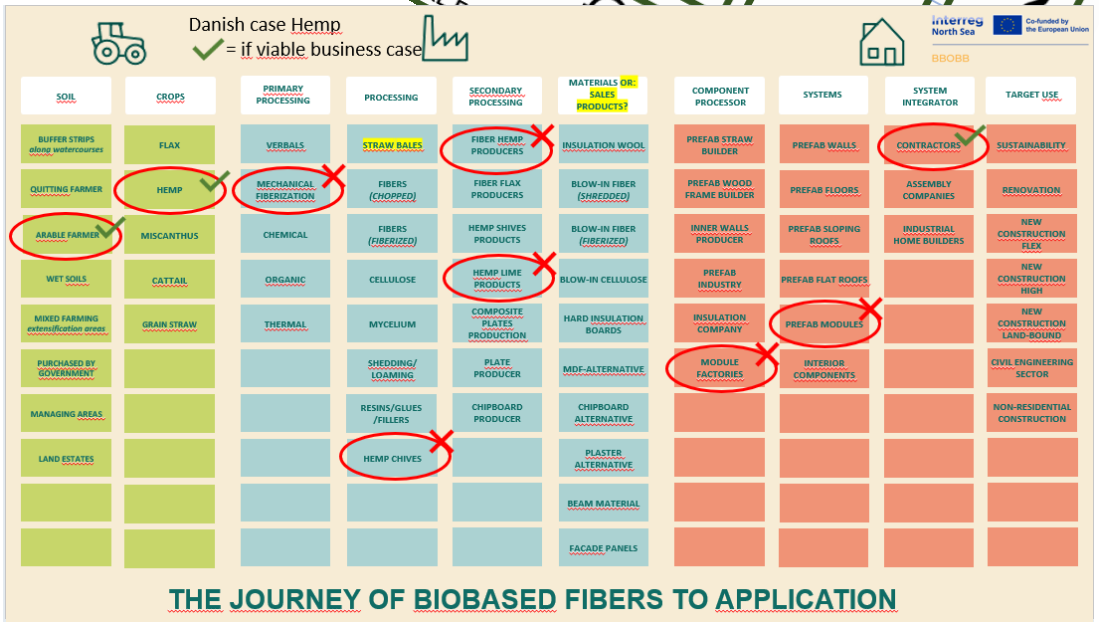
The value chain for processing hemp into building materials in Denmark is still at a very early stage.

There are initiatives underway, but they are primarily based on imported hemp fractions that have been processed into shives or fibres outside the country.

In the BBoBB project, we work to strengthen the hemp value chain by engaging with industry organisations in both construction and agriculture, as well as partners in Denmark and abroad.

One option we are exploring is whether exporting unprocessed Danish hemp could make cultivation economically viable for the farmeres.

If enough hemp is grown, it may help lay the foundation for the next steps in the value chain.



The potential for hemp cultivation

Economy

Since the value chain for industrial hemp is still undeveloped, it is difficult to carry out solid economic calculations. However, to get an idea of the potential, we have looked at price levels for hemp in other parts of the EU.

A realistic yield under Danish conditions should be around 25 tons of fresh biomass per hectare, corresponding to approximately 10–12 tons of dry matter.

NB: Sources disagree on the yield potential, so 10–12 t/ha may be optimistic. Other sources mentions 7-10 t/ha.

The potential for hemp cultivation

Economy

A realistic price for retted hemp would be 130–250 €/ton (dry matter), equal to 1,300–3,000 €/ha (10-12 t/ha).

At best, this gives a harvest value that is fully comparable to traditional cereal crops.

But – the wide price range shows that good economic performance depends strongly on maintaining hemp quality. This is even more true if the yields are lower (7-10 t/ha).

Transport costs are high, which may limit export potential

Harvesting is also costly due to the lack of suitable local machinery.

The potential for hemp cultivation

Carbon balance in the field/climate

Scenario A – Hemp grown for fibre (retted in-field)
A typical hemp crop yields around 12 t DM/ha, of which about 9 t is harvested and 3 t remains in the field (roots, stubble, leaves, and retting losses).

This leftover biomass can lead to a soil carbon change of approx. 0 to +0.3 t C/ha/yr, meaning hemp is carbon-neutral to slightly carbon-positive under normal Danish conditions.

The potential for hemp cultivation

Carbon balance in the field/climate

Scenario B – Cereals with straw removed, no cover crops
Most carbon is exported as grain and straw, leaving only 1–2 t DM/ha of roots and stubble.

Long-term studies indicate a soil carbon loss of –0.1 to –0.3 t C/ha/yr, giving cereals a slightly negative carbon balance unless compensated by other practices.

Scenario C – Cereals with straw incorporated + cover crops
With straw returned and cover crops added, cereals can approach hemp levels.

SOC change is typically 0 to +0.2 t C/ha/yr, meaning carbon-neutral to slightly positive, similar to well-managed hemp.

The potential for hemp cultivation

Agronomic advantages

Soil structure
Hemp develops a deep and dense root system that loosens the soil at depth and improves soil structure.

Crop rotation benefits
Hemp grows quickly and covers the soil early, which suppresses weeds. Because it shares few serious diseases or pests with other common Danish crops, it also supports a healthier crop rotation by breaking disease cycles.

Pre-crop value
Hemp has a high pre-crop value primarily due to improvements in soil structure and its positive effects on weeds and diseases, but also because it leaves substantial organic matter that contributes to the nutrient cycle.

The potential for hemp cultivation

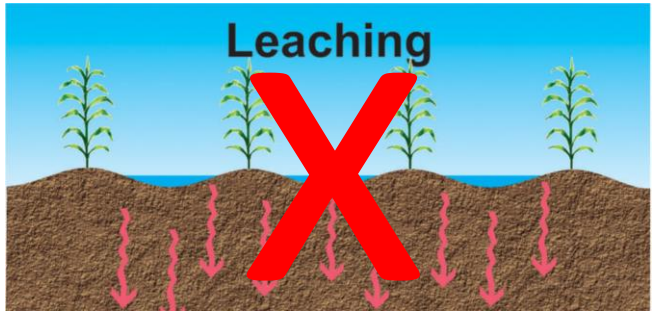
Environmental impact

Pesticides

Hemp requires very little or no pesticide use because it grows quickly, suppresses weeds, and has few shared pests or diseases with other crops.

Nitrogen losses

Hemp shows a low risk of nitrogen leaching because it continues growing late into the season and uses most of the available nitrogen. Its long growth period and high biomass production mean that little mineral nitrogen is left in the soil after harvest. The remaining roots and plant residues also bind nitrogen in organic form, reducing the amount of free nitrate that could leach.



Biodiversity

Hemp generally supports higher biodiversity than cereal crops because it requires no pesticides, produces abundant pollen, creates a more varied crop structure, and remains in the field later in the season

The potential for hemp cultivation

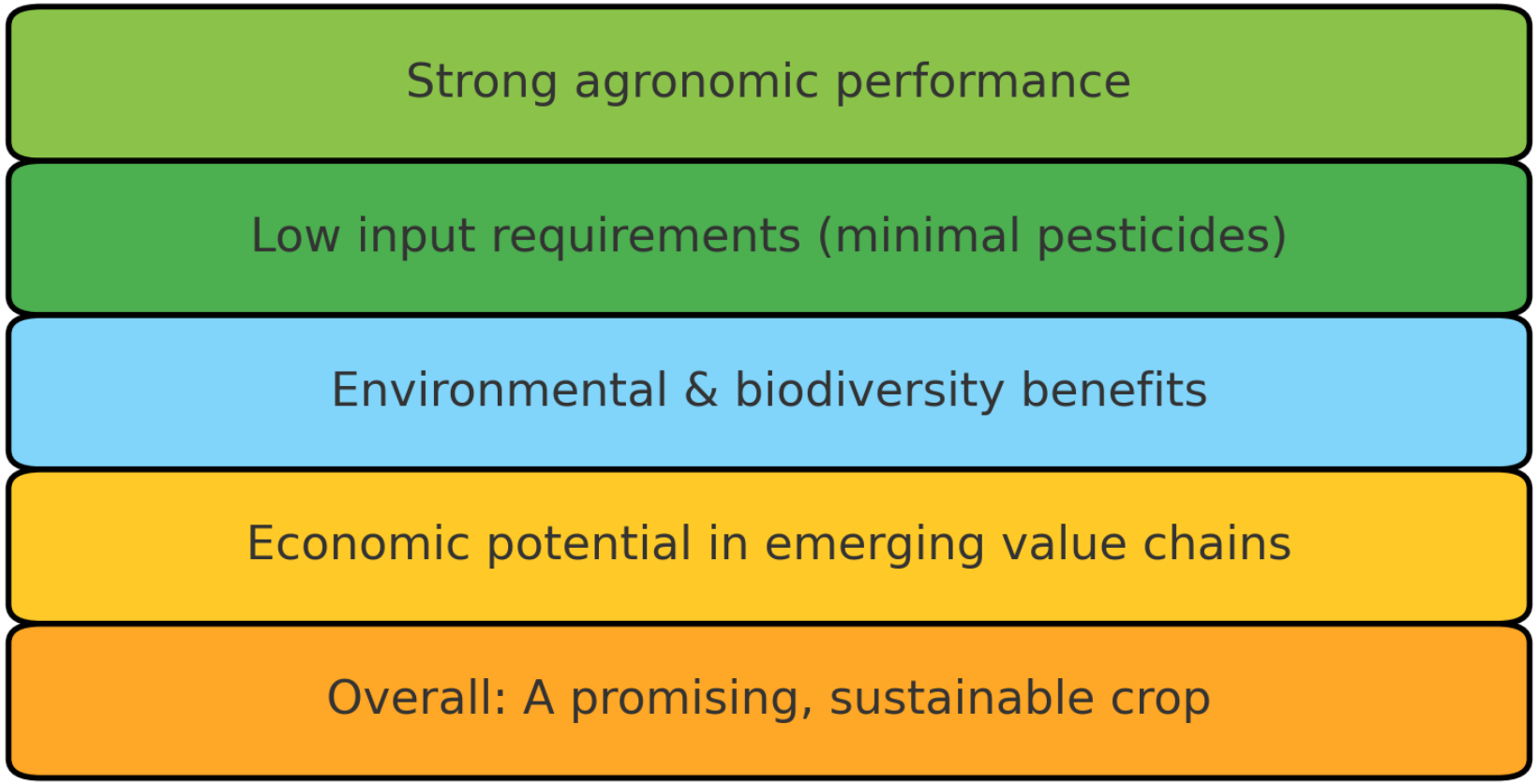
Additional dimension

Hemp in buildings
The major potential, of course, lies in using hemp for building materials, allowing us to store carbon in buildings while reducing the use of mineral-based construction materials that require large amounts of energy to produce.

Carbon stored in hemp products
LCA studies show that hemp for building materials can deliver strongly negative CO_2 footprints because the carbon remains stored in buildings for decades. One study found that ~15 tonnes of hemp per hectare resulted in about –26 t CO_2-eq/ha when cultivation, processing, and long-term storage were included.

The potential for hemp cultivation

Overall conclusion



Thank you for your attention
Questions?