

**A Hemp Inspiration Session**

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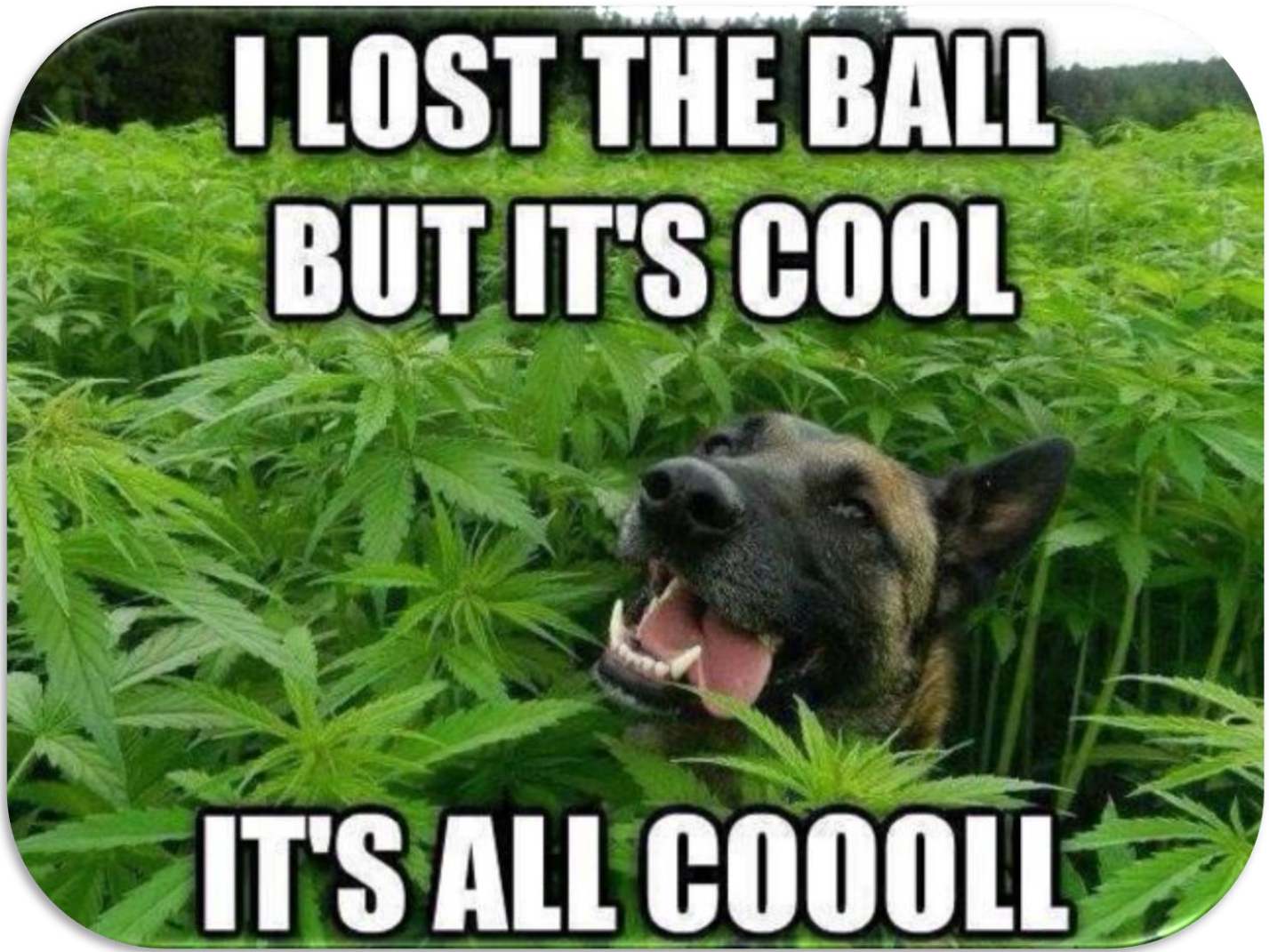
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BBOBB

# A Hemp session Inspiration

Bert Vuylsteke  
– Biodesign expert



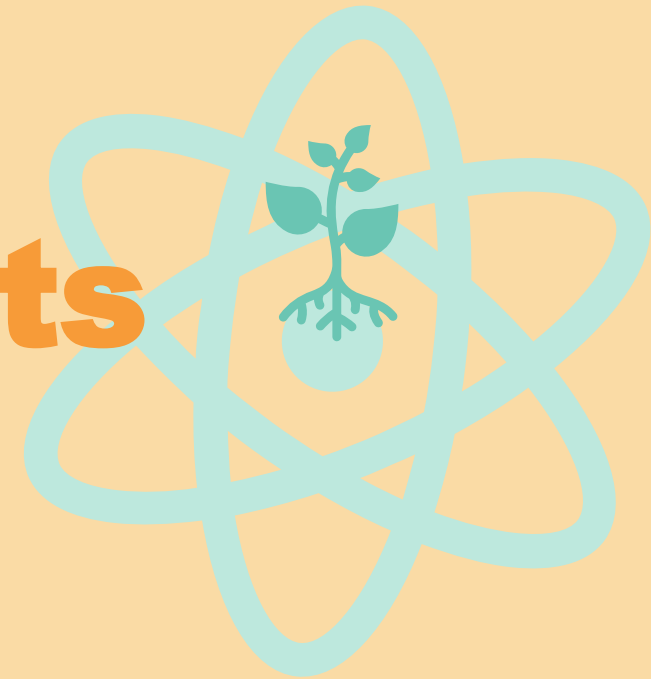


# Overview

- 1. Hemp's unique traits**
- 2. Applications**
- 3. Status on hemp cultivation and value chains**
- 4. Current obstacles**
- 5. Current enablers**



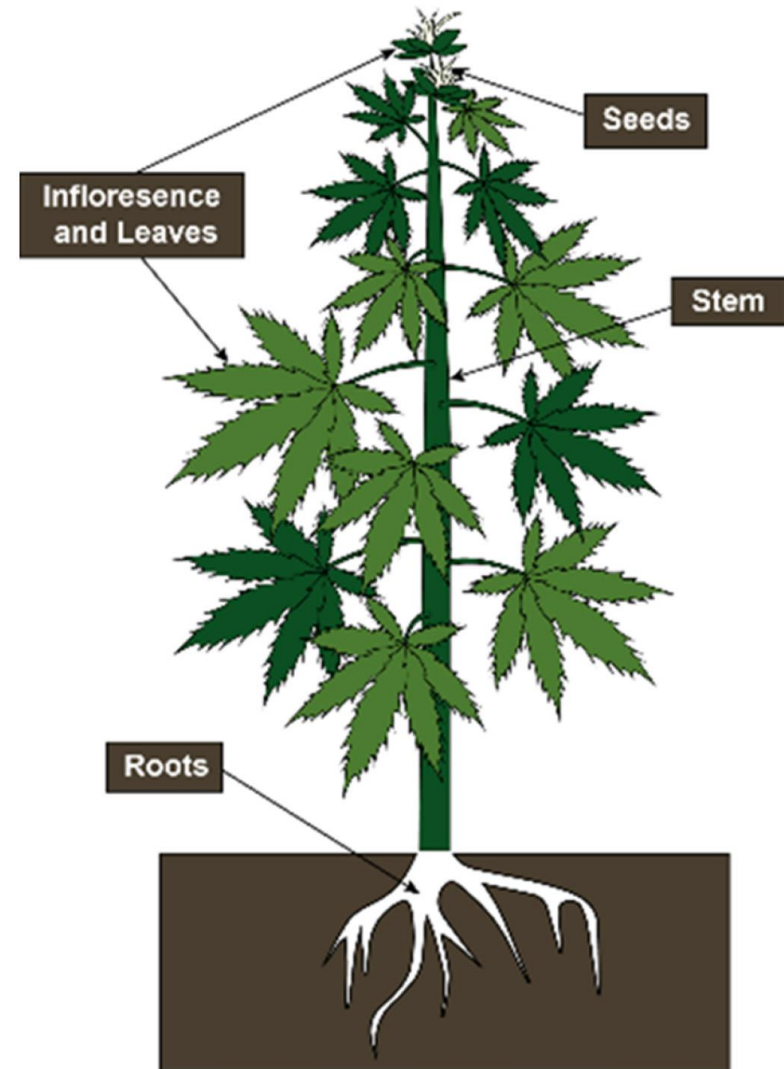
# Hemp's unique traits



# Hemp's unique traits

## What is hemp???

- ***“Cannabis sativa Linn”***
- **Grown for industrial commercial use**
- **Unlike marijuana (another variety)**
- **<0,3% THC (hallucinogenic compound)**
- **The plant:**
  - **Stem = fibers + shives**
  - **Leaves = oils, medicinal**
  - **Seeds = oils, food, non-food**
  - **Roots = soil enhancing, medicinal**





# Hemp's unique traits

## Down memory lane

- **8000 BC – 1950s worldwide cultivation (one of the oldest cultivated fibers)**
- **1937 – hemp cultivation ban in US after marijuana tax act (classified under controlled substances)**
- **2014 – farm bill redefined industrial hemp, allowing for cultivation in US again**
- **Now – cultivation ever increasing**

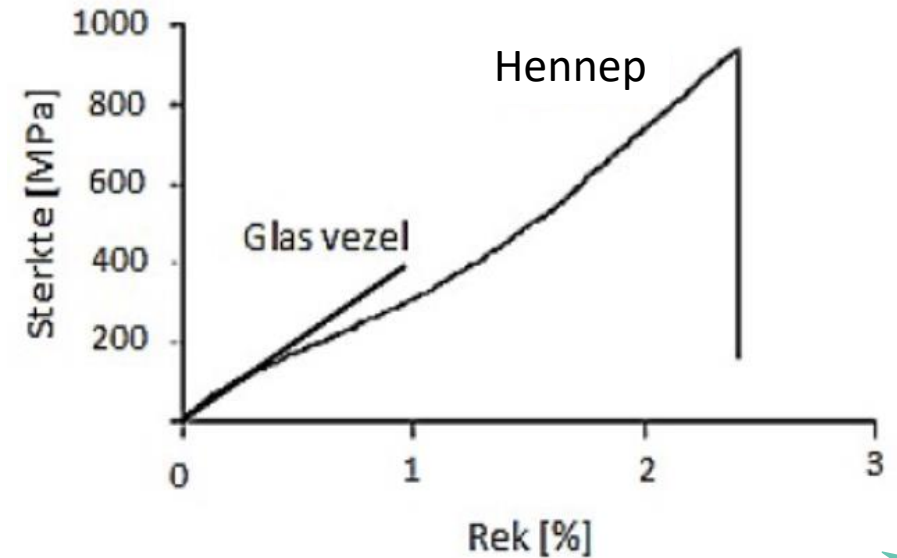
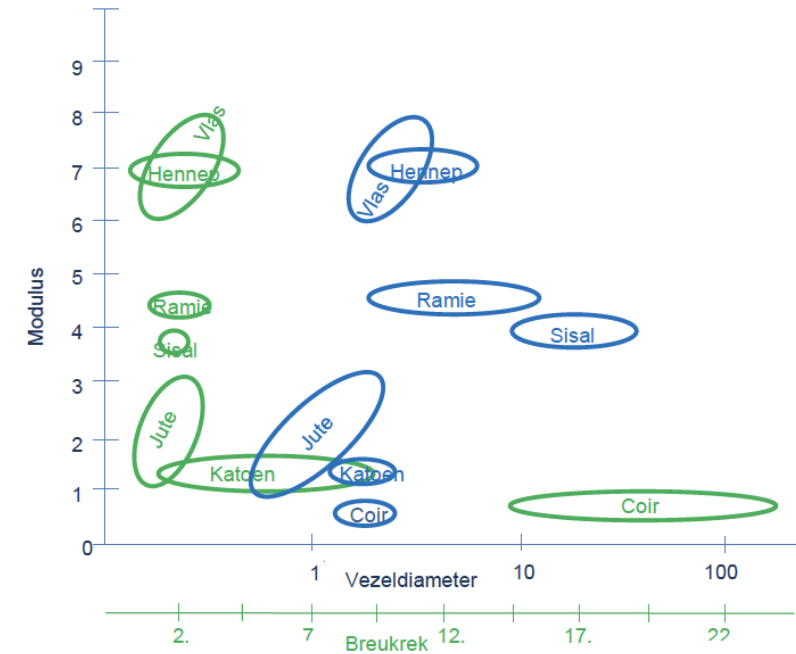


# Hemp's unique traits

## Mechanical properties hemp fibers

- **Hemp fiber performs well compared to both synthetic and natural alternatives (glass-, flax-, hessian-, coir-, etc. fiber)**
- **Two unique characteristics typical form hemp fiber = SOFT & DURABLE**

Vezel	Dichtheid [kg/m <sup>3</sup> ]	E Modulus [GPa]	Sterkte [MPa]	Specifieke stijfheid [MPa m <sup>3</sup> /kg]	Rek [%]	Lengte [mm]
E glas	2500 – 2590	70 – 85	1400 - 3500	28-34	1,8 - 4,8	Continu
Vlas	1400 - 1500	50 – 90	500 - 1100	35,7-59,2	1,2 - 3,3	5 – 900
Hennep	1470 - 1520	30 – 70	400 - 920	20,3-46,7	1,4 - 4	5 – 1000

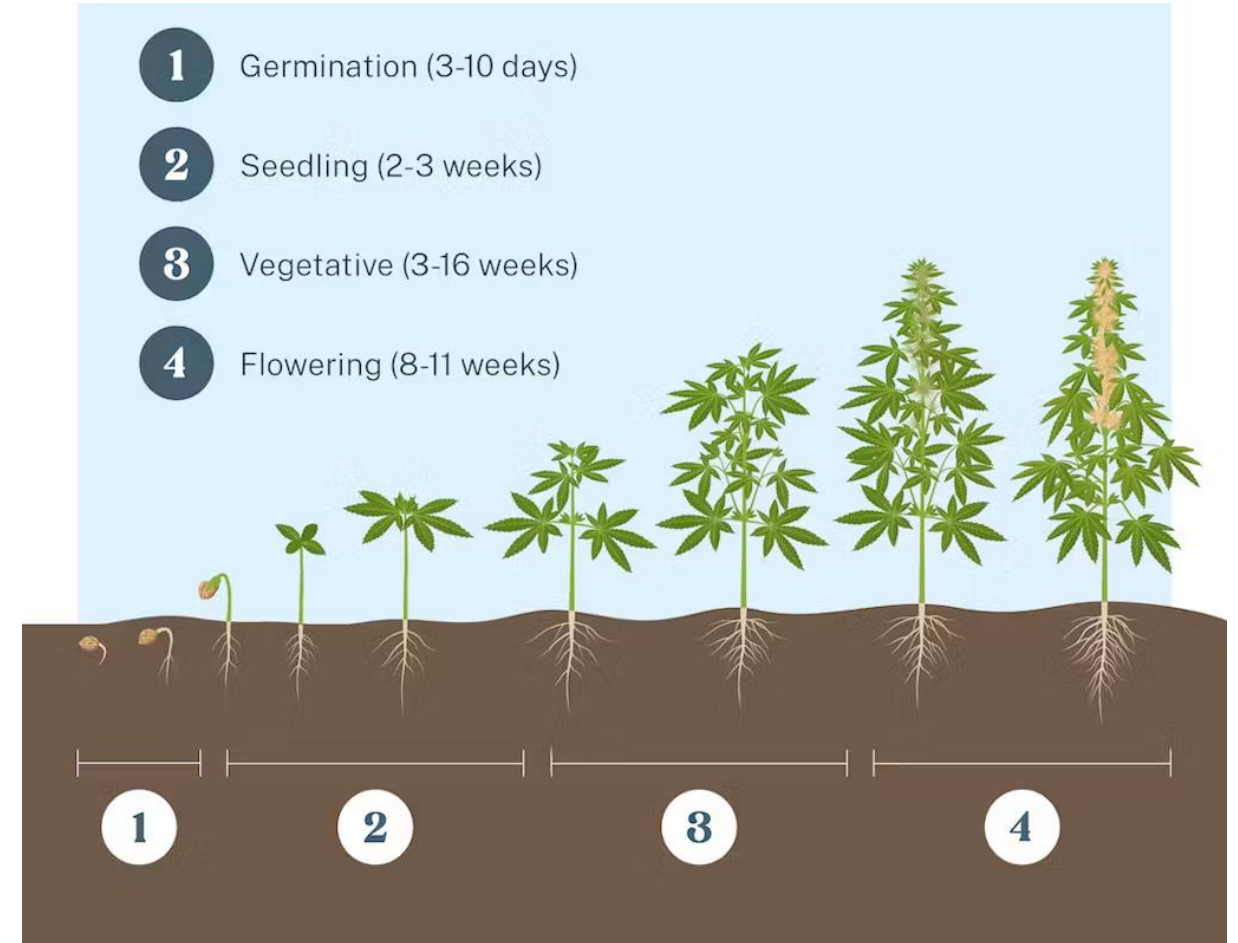




# Hemp's unique traits

## Sustainability traits

- **Rapidly renewable resource**  
= **Growth cycle of 3 months**
- **Captures 5 to 10 times more CO<sub>2</sub> than natural forestry**
- **Robust crop**  
= **few water consumption**  
= **few to no need for fertilization**
- **Phytoremediating crop**
- **Deep root system ideal for soil quality preservation and improvement**
- **Perfect rotational crop**



# Applications



# Applications

## 1 ha of Hemp???

- **Co-creates & regenerates eco-systems:**
  - **8 to 15 ton CO2 captured**
  - **Increased biodiversity**
  - **More healthy soil**
- **Application potential:**
  - **Textile to make 2000 T-shirts**
  - **1200 chairs**
  - **1 domestic house**

## ONE ACRE OF HEMP =



8 – 15 ton



MORE



HEALTHY



2000



1200



1



# Applications

## Goal

- **If CO<sub>2</sub> is captured rapidly**
- **Then, we better store it for a long time too!**
- **Ideally, long lasting applications**
- **Fully biobased is the bar**  
= Meaning the minimum requirement!  
= Do not inseparably combine synthetic compounds with biobased streams
  - → Green washing, even though more carbon would be captured than produced, problem is still being postponed
  - → Contaminating bioeconomy





# Applications

## Fibers

- **Particles (chopped hemp)**
- **Discontinuous fibers**
  - = short fibers
  - = also called "*hurd fibers*"
  - = from inside the stem
  - = wood substitution in paper production, insulation, animal bedding, construction composites
- **Continuous fibers**
  - = long fibers
  - = also called "*bast fibers*"
  - = outside of the stem
  - = can be cleaned, spun and woven / knitted into fabrics



# Applications

## Fibers for Composites

- **Chopped hemp**
- **Random orientation fiber mat**
- **Unidirectional fabric**
- **Bi-directional fabric**





# Applications

## Applied

- **Automotive industry – Ford Hemp car**

*'Grown from the soil'*  
**Ford's HEMP CAR**

.....

**One of Henry Ford's first cars ran entirely on Hemp ethanol. The body was also constructed from Hemp plastic, which was 10x stronger than steel.**

Of course - Hemp was then outlawed in the US in 1937 due to the potential damaging effect it would have on many powerful industries at the time, including oil, plastics & paper giants.

Imagine where we would be today had these power hungry tyrants not suppressed the amazing bio-technologies of Hemp?

Hemp Fiber → Non-Woven Mat → Pre-Finished Door → Finished Door



# Applications

## Applied

- **Automotive industry – Ford Hemp car**
- **Battery technology – WinBat**



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- **Textile cloth**





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- **Textile cloth**
- **Medicinal – Oils, Hygiene products, etc.**



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- **Paper**





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- **Paper**
- **Rope**



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- **Chipboards – Hempwood**
- **Textile cloth**
- **Medicinal – Oils, Hygiene products, etc.**
- **Paper**
- **Rope**
- **Food – Vegan milk, Oil, Beer, Flour, Protein powder, Seed, Vegan cheese**



# Applications

## Applied

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- **Insulation panels – Hemp mycelium panels**
- **Chipboards – Hempwood**
- **Textile cloth**
- **Medicinal – Oils, Hygiene products, etc.**
- **Paper**
- **Rope**
- **Food – Vegan milk, Oil, Beer, Flour, Protein powder, Seed, Vegan cheese**
- **Coatings – Varnish, Paint, Oils**
- **Etc. and more to come!**



# Status on hemp cultivation and value chains



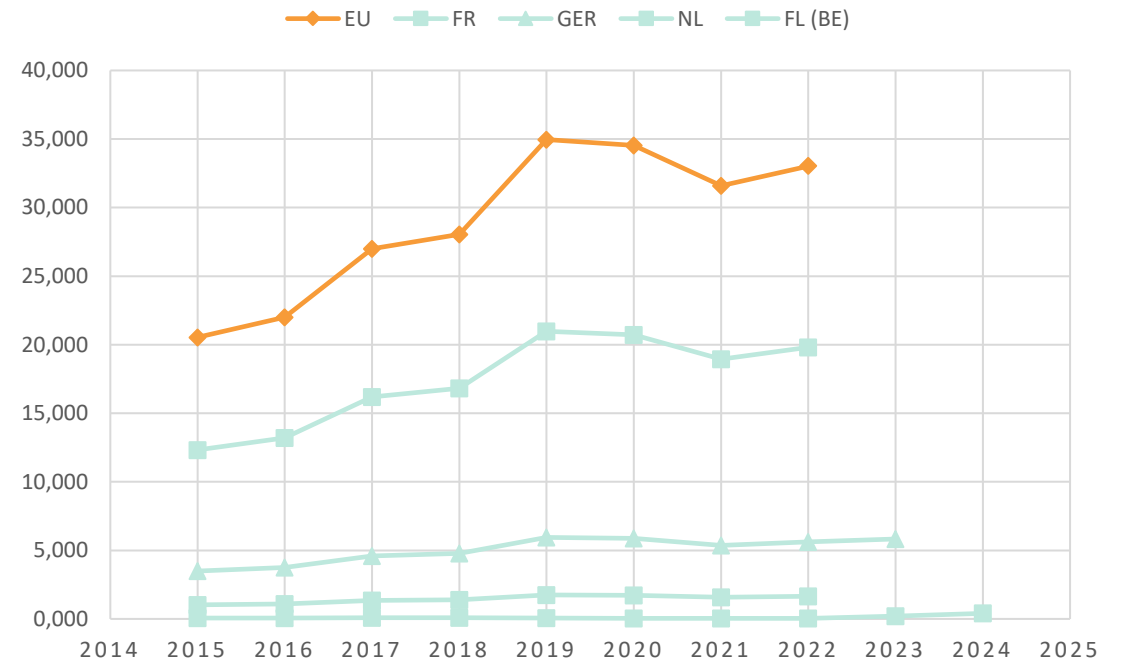


# Status on hemp cultivation and value chains

## LAND AREA USED FOR HEMP FIBER CULTIVATION IN 1.000 HA

YEAR	EU	FR	GER	NL	FL (BE)
2015	20,540	12,324	3,492	1,027	0,068
2016	22,010	13,206	3,742	1,101	0,076
2017	27,000	16,200	4,590	1,350	0,089
2018	28,050	16,830	4,769	1,403	0,095
2019	34,960	20,976	5,943	1,748	0,075
2020	34,540	20,724	5,872	1,727	0,045
2021	31,590	18,954	5,370	1,580	0,041
2022	33,020	19,812	5,613	1,651	0,040
2023	nan	nan	5,834	nan	0,195
2024	nan	nan	nan	nan	0,404

## LAND AREA USED FOR HEMP FIBER CULTIVATION IN 1.000 HA

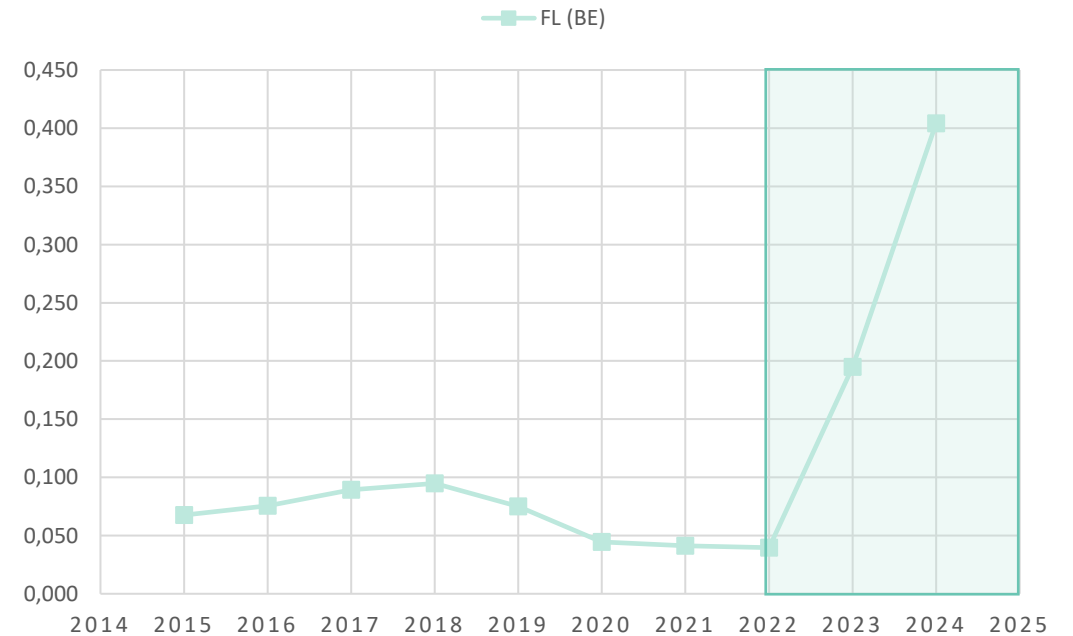


# Status on hemp cultivation and value chains

## Flanders

- **Project Vlaio Circular Living Lab Hemp+ Project**
  - **Getting the hemp motor kickstarted and breaking the endless cycle of who will be the initiator.**
    - **Suppliers (farmers) need good prices and other added values as a reason to start cultivating hemp**
    - **Purchasers, processors and customers need steady supply at good price and other added value to start using hemp-based products.**

**LAND AREA USED FOR HEMP FIBER CULTIVATION IN 1.000 HA**



**CCL Hemp +**



# Status on hemp cultivation and value chains

## Flanders

- **Yield/ha depends on hemp application**
- **Sowing densities and yield example:**
  - **Textile hemp = high sowing density for thin plants with lots of primary fiber**
    - 50 to 80kg/ha seed
    - yield 4 to 8 ton/ha after retting and pressing
  - **Hemp for seeds and tops = low sowing density for tops to have enough space to properly develop**
    - 25kg/ha seed
    - yield no numbers currently
  - **Industrial chopped hemp = medium sowing density**
    - 60kg/ha seed
    - yield 8 ton/ha without retting (high moisture content)



# Status on hemp cultivation and value chains

## Value chain mapping highlights:

- **The present chain links:**
  - **Interest from many research centers to kickstart the hemp acreage**
  - **Farmers seeing the added value of incorporating hemp in their farming systems**
  - **Regulatory procedures for hemp cultivation permissions are in place**
  - **Processors in construction industry are uptrending (e.g. BE: C-biotech, GER: Schönthaler, Hanffaser)**
  - **Processors in textile industry (e.g. BE: Libeco, FR: Safilin)**
  - **Interest from designers (e.g. DK: Hemp House – Aboutna)**



# Status on hemp cultivation and value chains

## Value chain mapping highlights:

- **The lagging chain links:**
  - **Limited seed suppliers (e.g. NL: GreenInclusive, BE: C-biotech)**
  - **Few companies experienced in hemp harvesting (e.g. Hyler)**
  - **Still few large scaled applications, but steadily growing with the increasing supply**



# Current obstacles





# Current obstacles

## Farmers

- 1. To phytoremediate brown fields, harvesters and combines can hardly reach those type of grounds**
- 2. Hard to find purchasers or processors (next link in the chain)**
- 3. Procedure for permission to cultivate hemp**
- 4. Compacted soil negatively affects hemp growth**



# Current obstacles

## Farmers

5. **Feed crops VS Industrial crops**
6. **Hemp still needs little fertilization for a guaranteed yield**
  - **Issue for nitrogen decrete**
  - **Issue for brown fields (which cannot change in composition)**
7. **Tourists disturbing the hemp growth (e.g. growing marihuana variety in the industrial hemp fields)**



# Current obstacles

## Research centers

- 1. Own few grounds to experiment on**  
→ **Polluted soils are owned by (1) private, (2) communities, (3) cities**
- 2. Convincing society of the potential of hemp**



# Current obstacles

## Processors

- 1. Guaranteed supply and quality of hemp**
- 2. Composites with natural fibers are more susceptible for moisture**
- 3. Composites need fully biobased matrix (binding agent)**
- 4. Long fibers, but hard to manufacture continuous fibers**





# Current enablers



# Current enablers

## Farmers

- 1. Crop for rotational farming system**
- 2. Deep rooting system enhances soil quality (next crop after hemp cultivation in a rotational system has higher yield)**
- 3. Hemp needs fewer fertilization compared to other crops**
- 4. To suit the application, many hemp varieties are available**
- 5. To suit the application, one should choose the right harvest time**
- 6. CO<sub>2</sub> capture certificates / grants (future)**
- 7. Growing on soils with fewer soil quality or unused**



# Current enablers

## Research Centers

- **Temporary use of unused and brownfields**
- **Phytoremediation soil**
- **Avoiding unused terrains**
- **Avoiding illegal dumping waste, dust formation and land erosion**



# Current enablers

## Processors

- **Start-ups in a nich hemp market can make a difference**
- **Hemp is an alternative sustainable resource to manufacture goods with**
- **Hemp as valuable alternative to crops which are yielding less due to changing climate conditions (e.g. flax)**
- **New harvester and combine machines ease cultivation (timing, application, purchasers, etc.)**





# Summary Video



# Samples



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**Thank you**







**Want to connect  
on LinkedIn?**



# Q&A



# Sources

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