Hemp (Cannabis) Overview

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Introduction

People in many cultures have prejudices against hemp because of its sources of drugs. But *Cannabis* is more than a drug. It is a useful renewable resource for an ecological way of living, and in a sustainability-based society, hemp would play a more important role than it does today.

Biology

Cannabis indica (Latin: of India)
→ psychoactive substances
Cannabis ruderalis (Latin: weedy)
→ wild and not domesticated
Cannabis sativa (Latin: cultivated)
→ industrial hemp for fibre and seed production
→ all products shown here

Cannabis (hemp) belongs – together with *Humulus* (hops) and *Celtis* (hackberry) – to the familiy of Cannabinaceae.

Uses for the Cannabis Plant

Hemp can be used in 25,000 different products, from clothing to food to toiletries.

Figure 1: Cannabis sativa

Paper (1)
Printing paper
Fine/Specialty paper
Filter paper
Newsprint
Cardboard/Packaging

Building Materials (2)
Insulation
Caulking
Fiberboard
Fiberglass substitute
Cement
Stucco and mortar

THC/CBD (5)
Medicine
Recreation

Food (6)
Salad or Cooking Oil
Supplements
Chocolate
Cereal, Dessert, Drinks

Bast Fibre

Hurd (pulp)

Leaves

Flowers

Hemp Nut

Body Care (7)
Soap
Shampoo
Hand Cream
Cosmetics

Hemp Oil

Industrial Textiles (3)
Rope
Canvas
Twine
Fabrics
Nets
Tarps
Carpets

Consumer Textiles (4)
Apparel
Denim
Bags
Socks
Diapers
Shoes

Stalk

Seed

Seed Cake

Technical Products (8)
Oil paints
Varnishes
Printing inks
Diesel Fuel
Lubricants
Coatings

Light green = On display

(whole plant)
Boiler fuel
Pyrolysis feedstock

Animal feed
Protein-rich fiber

Agriculture

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Cultivation

Hemp is usually planted between March and May in the northern hemisphere, between September and November in the southern hemisphere. It matures in about three to four months.

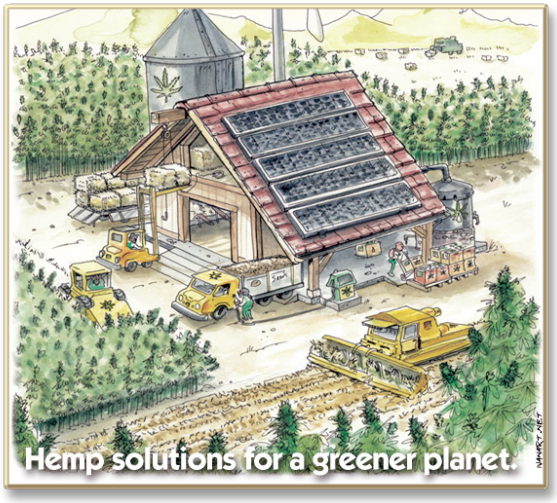

Figure 1

Agricultural benefits

- it is a potentially profitable crop having the right profile to fit into sustainable farming systems
- it offers alternative land use and can be considered a key rotation crop. It provides several direct benefits including the reduction of pesticides, while increasing the yield of crops following it in rotation
- it has a high farmer perception. Being an annual crop, hemp does not require a long-term commitment in land use and moreover has a management similar to other conventional crops
- it could play a potential role in the remediation of soils contaminated with heavy metals
- it has lower negative impact on the environment than other crops:

	Arable crops												
Atlantic central/ Lusitanian	**Hemp**	**Double cropping**	**Mustard seed**	**Clover Alfalfa**	**Linseed**	**Sun-flower**	**Sorghum (only in Lusithanian)**	**Other cereals (Barley, rye, oats, triticale)**	**Oilseed rape**	**Wheat**	**Potatoes**	**Sugar beet**	**Maize**
Erosion	A	A	A/B	A	B	B/C	B	B	A	B	C	C	C
Soil compaction	A	A	A	A/B	A	A	A	A	A	B	C	C	C
Nutrient inputs into ground and surface water	A	A	A/B	B	B	A	B	B	C	B	B/C	C	C
Pesticide pollution of soils and water	A	B	A	A	B	B	B	B	C	B	C	C	B
Water abstraction	B	B	B	A	A	B	B	A	B	B	B	B	C
Increased fire risk	-	-	-	A/B	-	-		-	-	-	-	-	-
Link to farmland biodiversity	B	B	A	A	B	A	B	B	B/C	B/C	C	B	C
Diversity of crop types	A	A	A	A	A	A	A/C*	B	B	C	B	B	C

Figure 2: Environmental risk matrix for crops (A = lowest impact , B= medium impact, C = highest impact on environment)

History of prohibition

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1850s	Hemp *Cannabis* peaks globally: East Asian *indica* hemp introduced to Europe and North America
1870s-1910s	Multiple colonial and independent states in South Asia, southern Africa and the Americas prohibit recreational drug *Cannabis* use in order to control labourers
1880s-1930s	Anti-drug authorities protray drug *Cannabis* as certainly inducing madness and violence in users
1925	Cannabis indica is included as a controlled substance in the International Opium Convention
1938	Cannabis drug prohibition begins in the U.S.
1950s	Commercial hemp production is moribund in Europe and ceases in the U.S.; the Chinese state discourages hemp
1961	The Single Convention on Narcotic Drugs standardizes legal controls on drug *Cannabis* among United Nations member states
1960s-1970s	*Cannabis indica* gains global popularity as part of social and political upheavals; celebrities popularize drug use in music, literature, film and art
1960s-present	The popularity of hand-rolled drug *Cannabis* cigarettes creates demand for hemp *Cannabis* rolling papers
1973	U.S. President Richard Nixon declares a global War on Drugs, which continues today
1990s-present	The 'Hemp Renaissance' develops as people seek renewable sources of raw materials; several countries worldwide re-legalize hemp production
1996-present	In the U.S., California and Arizona legalize medical marijuana use; eighteen states (and Washington, DC) follow by 2014; other countries allowing some medical use include Austria, Canada, Finland, Germany, Israel, Italy, the Netherlands, Portugal, Spain, Sweden.
2012	In the U.S., Colorado and Washington State legalize recreational marijuana
2013	Uruguay legalizes the cultivation, sale, distribution and use of *Cannabis indica*
2014	Colorado's government-regulated recreational marijuana market opens; the state reports $14 million in sales and $2 million in taxes during the first month of business

➡ **The decline of industrial hemp came along with the prohibition of marihuana. Until now farmers and producers of industrial hemp feel the (after-)effects of prohibition.**

Paper (1)

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Hemp paper industry

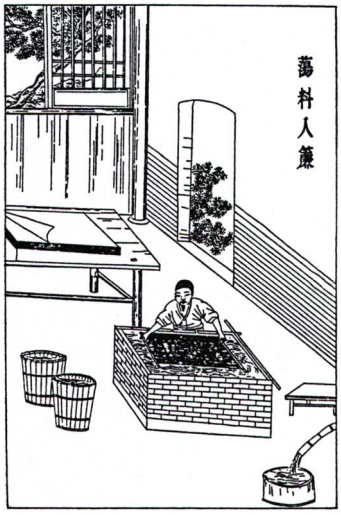

Figure 1: Hemp paper making in ancient China

75-90 % of all paper in the world was made with hemp fiber until 1883. Books, maps, paper money, stocks and bonds, newspaper etc. were printed on hemp paper. It was made from discarded sails and ropes (see 3. industrial textiles), or worn-out clothes, sheets or rags (rag paper).

In 2013, 57 % of the European hemp fibre production was used for the pulp and paper industry. The applications are limited to a very few applications: technical filters, bank notes, bible paper and cigarette paper. As the production is very expensive the only well established market for hemp pulp is the cigarette paper market.

Hemp paper

Hemp paper lasts longer than conventional paper. So hemp bast fiber is a very promising resource for the manufacturing of permanent paper.

On display:

- Gmund Cannabis Pur: 100% hemp pulp
- Hemptec for copier, laser and inkjet: consists of at least 30% pulp made from hemp shive and of 70% softwood (sawmill waste).

Hemp is an environmentally sound source of pulp fibre; chlorine-free bleaching ensures this standard is continued through the production process.

Because of its yellow/grey colour and a higher selling price hemp paper is not produced in Europe anymore.

Envelope

This envelope is made of 100% hemp and has a hemp leaf watermark.

Printed on hemp paper

Building Materials (2)

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Insulation wool

Hemp as insulation material is an eco-friendly alternative for glass wool or Polystyrene (see Fig. 1 and 2) and has comparable insulating properties. The use of this natural material improves the sustainability performances of the final product. The insulation wool is made of short fibers of hemp plants.

Figure 1: Roof insulation

Caulking Strips

Made of fine hemp fibres caulkings strips can be used for sealing pipes or windows (Fig. 4).

Footfall sound insulation

The hurd is mixed with fibre and sandy loam to get a very effective footfall sound insulation (Fig. 5). 140 mm hemp-loam-mix and 50 mm screed has an outcome of 30 dB silencing.

Figure 2: Wall insulation

Hurd based building blocks (Fig. 3)

Figure 3: Wall constructed of Hempcrete – a biocomposite material consisting of hurd, lime, water and a binder.

Figure 4: Caulking

Figure 5: Footfall sound insulation

Industrial Textiles (3)

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Ropes

The first ships that sailed across the oceans were equipped with sails and rope made from woven and braided hemp fibre.

The Golden Age of the Low Countries was also the golden age of hemp. The Dutch East India Company (VOC) was only too happy to promote the cultivation of hemp plants, because in those days hemp, besides wood, constituted the most important shipbuilding material (see Fig. 1). The merchant fleet required large quantities of hemp: every part of the ship not made out of wood, consisted of hemp.

Hemp sails and hemp rope are extremely strong and withstand the influence of salt water and mildew.

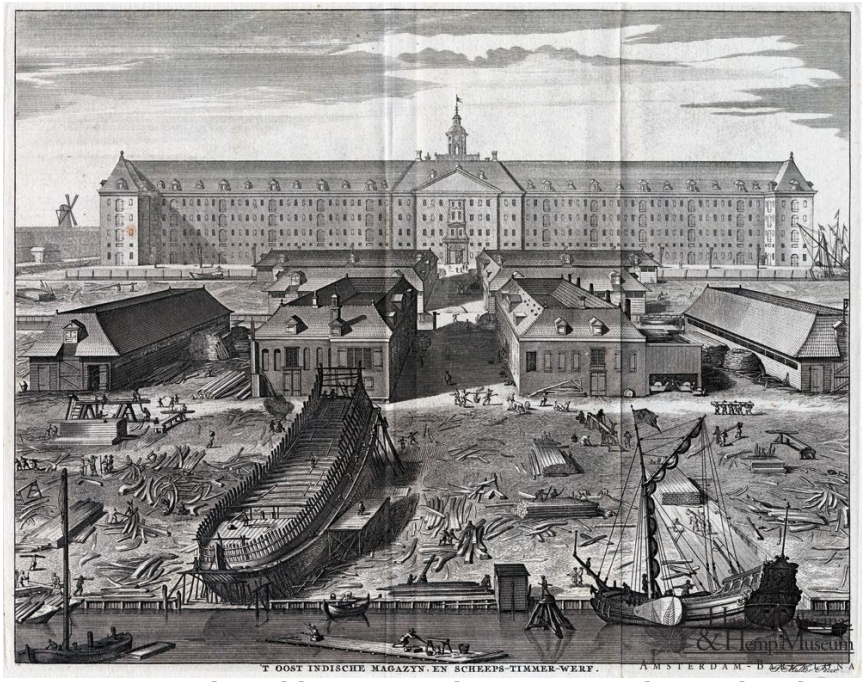

Figure 1: Joseph Mulder, East India Company shipyard and warehouse in Amsterdam, circa 1700

The Amsterdam shipyard of the VOC (Dutch East India Company) was by far the largest and most important wharf in the Netherlands

Canvas / Fabrics

The word canvas, derived from the French „chanvre", meaning cannabis, dates from the 16 th century, when hemp first found widespread application.

The hemp fibre can be processed into very different fabrics. There's even a broader variety when combined with other ressources like cotton or silk.

Twine

If you need twine which is strong, durable and eco friendly just take hemp. Try to make your own twine and twirl some hemp wool.

Printed on hemp paper

Consumer Textiles (4)

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Production

When weaving with hemp yarns, you can treat it like a linen yarn, using similar setts. It improves and softens with age. The process of cottonization removes the lignin that binds the hemp fibres (and gives stalks their rigidity) to achieve softer textiles.

Benefits

Compared with cotton, hemp fibre has greater heat resistance and better moisture absorption and dispersion, while its high rate of absorption of toxic gases makes it excellent for use in household textiles. Hemp is also mildew resistant, making it an excellent yarn for towels, bath linens and carpet warp as well as in fine table linens and clothing.

Apparel

Shirts:	100% hemp, pesticide-free/herbicide-free, from China produced in China
Scarf:	100% hemp, pesticide-free/herbicide-free, from China produced in China

Denim

Jeans:	100% hemp, pesticide-free/herbicide-free, from China produced in Philippines and Poland

Socks

Socks:	94% hemp, 4% polyamide, 2% elastane pesticide-free/herbicide-free hemp from China produced in Germany and Hungary

Bags

Wallet:	100% regenerating raw material (except zipper) 100% recyclable
Backpack:	same material (Fig. 1)

Figure 1: Backpack

THC / CBD (5)

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Medicine

Δ9-tetrahydrocannabinol (THC) is already licensed for clinical use in the U.S.A. as an anti-emetic and appetite stimulant. THC-rich cannabis extracts show therapeutic potential as neuroprotective and anticancer agents and for the management of glaucoma, pain and various kinds of motor dysfunction associated, for example, with multiple sclerosis and spinal cord injury (see Fig. 1 for more effects of THC).

Young un-budded hemp plants provide extractions of CBDs (cannabidiolic acids). There are many antiobiotic uses of the cannabidiols. Potential clinical applications of CBD and CBD-rich cannabis extracts include the production of anti-inflammatory and neuroprotective effects, the management of epilepsy, anxiety disorders, glaucoma and nausea, and the modulation of some effects of THC.

Effects that have therapeutic potential
Analgesia, including relief from neuropathic and inflammatory pain
Effects on motor function, including relief from muscle spasms and spasticity
Neuroprotection
Inhibitory effects on gastro-intestinal tract motility
Anti-emetic effect
Reduction of intra-ocular pressure
Facilitation of sleep
Appetite stimulation
Inhibitory effect on cancer cell proliferation
Effects contributing to the "high"
Elevation of mood
Laughter
Loquacity
Effects on perception[a]
Feelings of increased insight and significance
Other effects
Impairment of cognition, learning and memory
Impairment of the ability to concentrate
Impaired psychomotor performance; ataxia; tremor
Sense of unreality, depersonalization and detachment
Fragmentation of thoughts
Feelings of panic or anxiety; dysphoria
Production/exacerbation of psychotic symptoms; paranoia
Effects on cardiovascular function including tachycardia and postural hypotension
Conjunctival reddening, reduced tear flow; dry mouth
Nausea and occasional vomiting
Effects on endocrine and reproductive function
Effects on thermoregulation

Figure 1: Effects of THC

Recreation

About 161 million persons or 4% of World population (aged 15 – 64) are estimated to have used cannabis as a recreational drug. The effects of cannabis are highly variable and depend upon the dose, pattern of use, previous experience with the drug, concurrent use with other drugs, user's expectations and social environment and the mood of the user.

Figure 2: Puppet smoking a joint

The most psychoactive constituent of cannabis is THC. If the cannabis is of low potency, the effects may be subtle and brief. But there are many cases of cannabis associated psychopathology.

Food (6)

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Hemp Nuts

Technically a nut, hempseed typically contains over 30% oil and about 25% protein, with considerable amounts of dietary fiber, vitamins and minerals. The seeds have a nutty taste and you can snack them raw. They can also upgrade your salad or be a substitute for nuts in baking or other recipes.

Hemp Oil

Hempseed oil is pressed from the Cannabis seed. It is over 80% in PUFAs (polyunsaturated fatty acids) an especially rich source of the two EFAs (essential fatty acids), linoleic acid (18:2 omega-6) and alpha-linolenic acid (18:3 omega-3). The omega-6 to omega-3 ratio (n6/n3) in hempseed oil is normally between 2:1 and 3:1, which is considered to be optimal for human health. The oil can be used in salad dressings, smoothies and other recipes but shouldn't be heated over 180°C.

Try hemp

- Protein Powder as dietary supplement. Enjoy it with water, juices, milkshakes or smoothies.
- Chocolate with hemp nuts
- Hemp dessert (with chocolate)
- Beer / Ice Tea with hemp flower flavor
- Cereal bar with hemp nuts and sesame seeds.

Figure 1-3: Variety of hemp food

Animal feeding

Recent feeding trials with fish, hens and ruminants have effectively demonstrated that hempseed and its derivatives are useful in animal feed as well.

Body Care (7)

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Hemp and Skin

As hemp oil has very skin-friendly properties it has become very significant as a “cosmeceutical” (cosmetic-nutraceutical), i.e., a body care product that promotes the health of skin and allied parts of the body. These products include

- soap
- shower gel / shampoo
- creams

as well as bubble baths, lip balms, lotions, moisturizers, perfumes etc.

Linoleic acid, alpha linolenic acid and gamma linolenic acid specifically have several functions related to skin care: they influence cell membrane functions including fluidity, transport of electrolytes and activity of hormones, and they stimulate cell immunology; these fatty acids are considered to have potential for treating neurodermatosis and psoriasis. Skin readily absorbs essential fatty acids, so that lotions rich in these substances can replenish cells damaged by sun and dry air.

Skin regeneration

A recent clinical study with topically applied hempseed oil has already demonstrated its usefulness in healing mucosal skin wounds after eye, nose and throat surgery. In a randomized, crossover study that compared hempseed oil and olive oil, improvements were seen in a population of patients with atopic dermatitis (eczema) within eight weeks after the ingestion of hempseed oil at 30 ml (2 tbs)/day. In this preliminary study, statistically significant improvements were seen in both skin quality and in plasma fatty acid profiles.

Antibacterial Properties

Antibacterial hemp in powder form can be incorporated into tooth powder, toothpaste, mouth-wash, toilet bars, antiseptic ointment, and foot powders. In hot weather, for example sweating and exercise generate a moisture-rich environment in shoes that stimulates overgrowth of both aerobic bacteria and fungi. Antibacterial foot soakings may provide relief.

Don't worry about loosing your drivers licence: Even an unrealistically extensive use of such products could not result in positive screening or confirmed urine tests for marijuana.

Printed on hemp paper

Technical Products (8)

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Industrial fluids

Figure 1: Hemp oil for wood finishing

Hempseed oil has been classified as a semi-drying oil, like soybean oil, and is therefore more suited to edible than industrial oil purposes. Nevertheless hemp oil has found applications in the past in paints, varnishes, sealants, lubricants for machinery, and printing inks, although petrochemical extracts have made these uses obsolete, and resurrection of such industrial end uses is unlikely because hempseed oil is expensive. However, larger production volumes and lower prices may be possible, in which case hemp oil may find industrial uses similar to those of linseed (flax), soybean, and sunflower oils, which are presently used in paints, inks, solvents, binders and polymer plastics. Hemp shows a remarkable range of variation in oil constituents, and selection for oilseed cultivars with high content of valued industrial constituents is in progress.

- Paints and varnishes: For instance, in 1935 alone, 58.000 tons of hemp seed were used in America just for paint and varnish. In ancient times many artists worldwide used hempseed oil for their oil paintings.
- Wood finishing oil (Fig. 1): Use on bare wood, over milk paint, chalk paint, and to revive old wood finishes.
- Lubricant (Fig. 2): Designed specifically for gardening tools and machinery. Using hemp oil makes it safe for both plants and skin.
- Diesel fuel (Fig. 3): Hemp seed oil has been used experimentally as diesel fuel, but far cheaper vegetable oils are available.

Figure 2: Lubricant for gardening tools

Figure 3: Car powered by hemp

Hemp ideas for a sustainable future (9)

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Figure 1: Hempearth plane made of 75% hemp. It will run on hemp-based bio-fuel.

Figure 2: BMW i3 saves weight using hemp fibers. Hemp-based door panel in the car.

Figure 3: Shoes

Figure 4: Hemp Bike

Figure 5: Hemp replaces wood

Printed on hemp paper

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