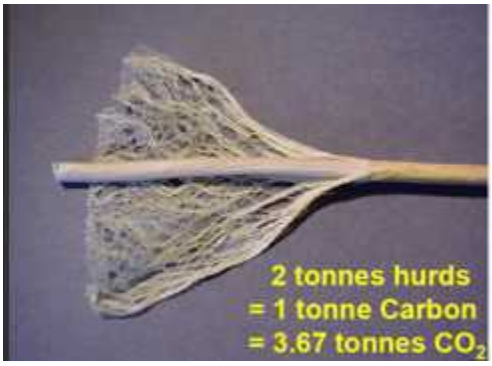
100% LEGAL IN OREGON. All you have to do to stay out of jail is get in the system and get a PERMIT.

INDUSTRIAL HEMP FARMING AND PROCESSING

Basics:
Industrial Hemp (iHemp) is made up of varieties of "Cannabis Sativa" that contain less than 0.3% Tetrahydrocannabinol (THC). It is an annual broadleaf plant with a taproot and is capable of very rapid growth under ideal growing conditions. The female flowers and seeds are indeterminate, meaning that there are both ripe and immature seeds on the same plants at the time of grain harvest.

Fibre hemp plants will grow to 2-4 meters tall without branching. In dense plantings (i.e.: seed drilled) the bottom leaves fall off due to lack of sunlight and the male plants die back after shedding pollen, generally 4-5 weeks into the growing cycle, lasting approx. 1 week.



The stem has an outer bark that contains the long, tough bast fibers. They are similar in length to soft wood fibers and are very low in lignin content. Hemp rope, textiles and clothing are all made from these fibers.

The core of the plant contains the "hurds" or "Shives" (short fibers), similar to hard wood fibers and these are used for building, particleboard (MDF) and pet bedding, as well as plastics.

For grain production the plant may branch and reach heights of 2-3 meters.

Tall plants do not mean more grain and shorter plants are preferred for combining. Combining means that it is easier to harvest with less labor.

Note Well.

In well structured and well drained soils the taproot of the hemp plant may penetrate 15-30 cm deep (12"). In compacted soils the taproot remains short and the plant produces more lateral, fibrous roots. The root structure of the hemp plant makes some of the finest, softest and strongest NATURAL ropes in the world.

Growing:
Each iHemp variety has its own set of characteristics; small or large seed, low or high oil content, different oil composition, etc.…

Varieties grown for fibre may contain from 15-25% bast fibres. As markets develop contracts to grow iHemp may specify the exact varieties that will meet specific market needs.

iHemp varieties tested in Ontario, Canada so far have all been of European origin with the exception of new Ontario-bred varieties such as "Anka" and "Carmen" and they come in 2 types; "dioecious", which have male & female flower parts on separate plants (i.e.: "Kompolti" and "Unico B") and

“monoecious”, which have male & female flower parts on the same plant (i.e.: “Ferimon” and “Futura”). A 3rd type of cultivar, known as female predominant, is a dioecious type that has 85-90% female plants. It is believed that this type of plant can yield more grain. Most French varieties are a hybrid of predominantly female types.

Only varieties of iHemp that are named in the list of approved cultivars, published by Health Canada, are approved for planting in Canada. These varieties are known to produce plants containing less than 0.3% Tetrahydrocannabinol (THC) under normal conditions. The THC level may vary with stage of growth and increase under environmental stress conditions. They mature to fibre in 60-90 days and to grain in 110-150 days. Using home-grown or “common” seed is illegal.

Dual Purpose Crops:
Most of the French and Romanian cultivars are suitable for grain and fibre production however these tall cultivars present some challenges for harvesting because growers need also to consider that weather conditions after grain harvest (late August or September) may not be suitable for retting & drying the stalks. The FIN 314 variety, which will grow to a maximum height of 0.9 meters (36 inches) and other short-stalked grain types (1-1.5 meters) are not suitable for dual production. Industry trends seem to be moving specifically towards grain or fibre varieties.

Soil Conditions:
iHemp responds to a well drained, loam soil with pH (acidity) above 6.0. Neutral to slightly alkaline (pH7.0 - 7.5) is preferred. The higher the clay content of the soil the lower the yield of grain or fibre. Clay soils are easily compacted and iHemp is very sensitive to soil compaction. Young plants are very sensitive to wet soils or flooding during the first 3 weeks or until growth reaches the fourth internode (approx. 30 cm or 12" tall). Water damaged plants will remain stunted, resulting in a weedy, uneven and poor crop.

Poorly structured, drought-prone sandy soils provide very little natural fertility or support for the iHemp plant. Extra nutrients and water will be required to achieve maximum yields on these soils, hence the extra costs make production uneconomical.

Climate for Growing:

iHemp requires lots of moisture; approx. 3-400mm (10-13”) of rainfall equivalent. If that amount of rainfall does not occur during the growing season it is important to make use of early soil moisture and to get early ground cover to reduce surface evaporation, as well as maintain good weed control. About ½ of this moisture is required during flowering and seed set in order to produce maximum grain yields. Drought during this stage produces poorly developed grain heads and continued drought results in low yields of light grain. During the vegetative growth period iHemp responds to daytime high temperatures with increased growth and water needs. After the 3rd pair of leaves develop iHemp can survive daily low temperatures as low as -0.5 degrees Celsius for 4-5 days.

Fertility:
iHemp requires approximately the same fertility as a high-yielding crop of wheat. Apply up to 110kg/hectare of nitrogen, depending on soil fertility and past cropping history. Research also supports the application of 40-90kg/hectare of potash for fibre hemp. Base your phosphorus (P205) and potash (K20) applications on a recent soil test. To interpret soil test information, follow the nitrogen, phosphate and potash recommendations for winter wheat in OMAFRA publication 811, “Agronomy Guide for Field Crops”.

Hemp growers in some places may benefit from adding sulphur. It is important to balance the nutrients applied with then crop requirements and with each other. For example; excessive nitrogen, combined with inadequate potash, can result in stalk breakage and loss of crop !

Approximately 42% of the plant's biomass returns to the soil in the form of leaves, roots and tops. These contain over half of the nutrients applied to the crop in the first place and many of these nutrients will be available to help feed the following crop.

Weed Control:
If hemp is planted into well-drained, fertile soil under nearly optimum temperature and moisture conditions, it will germinate quickly and reach 30 cm (12") in 3-4 weeks from planting. At this stage it will give 90% ground shade. Weed growth is suppressed by the exclusion of light from the soil. A rapidly growing iHemp population of 200-250 plants per square meter will suppress nearly all weed growth, including twitch grass. For pre-plant site preparation guidelines, refer to OMAFRA Publication 75, "Guide to Weed Control".

Weed suppression is not a permanent condition. Weeds may appear on the same field next year if the field is rotated out of iHemp production. Perennial grasses may be weakened or killed if iHemp is grown a 2nd year on the same ground however this practice increases the chance of crop diseases to develop.

Under grain production conditions weed suppression may be less complete; the lower plant population or uneven stands allow more light to penetrate the canopy, thus aiding the germination of weed seeds. Cross seeding may improve canopy distribution and subsequent weed control where early, shorter verities are grown. In conclusion; early planting, as soon as the soil is warm enough, is the recommended weed strategy.

Diseases and Pests:
More than 50 different viruses, bacteria, fungi and insect pests are known to affect the iHemp crop. However, iHemp's rapid growth rate and vigorous nature allow it to overcome the attack of most diseases and pests.

Botrytis Cinerea (grey mould) and Scierotinia Scierotiorum (white mould) are common moulds affecting iHemp. Scierotinia also affects edible beans, canola and sunflowers. Mould spores may be spread by combines, other harvesting equipment and straw.

A 4-year crop rotation is recommended as a good practice to avoid disease build-up. Do not grow iHemp on the same fields following canola, edible beans, soybeans or sunflowers.

Wind and hail damage can be significant to the iHemp crop. Tall plants with lots of upper leaf mass can be bent quite easily by mid-to-late summer storms. Broken plants will recover partially if not broken too low. This results in significant variability in plant height and maturity at seed harvest time.

Harvesting Fibre:
Air-dry stem yields range from 2.5-14.0 metric tons of dry, retted stalks per hectare (1 to 5 tons/acre) at 12% moisture. Approx. one ton of bast fibre and 2-3 tons of core material can be decorticated from 3-4 tons of good quality, dry-retted straw.

Yield of fibre depends on both the stalk yield per hectare and the fibre content of the stalk. Varieties differ in the amount of actual fibre content and on the ratio of bast fibre to core material (hurds). Dioecious varieties originating in southern Europe give the highest stalk yields. For textile applications, cut the iHemp in the early flowering stage or while pollen is being shed, but before seed sets. Fibre that is cut after seed harvest will have lignified considerably and is usable only in some non-woven industrial fibre applications. In dioecious varieties the male plants die back after shedding pollen. This results in lower fibre yields if the straw is cut after grain has matured.

On small acreages, good quality sickle-bar mowers and hay swathers have been used to cut iHemp. Frequent plugging has been a constant problem with this equipment. It is important to keep knives sharp and in good repair at all times. As acreage increases, more sophisticated equipment may have to be imported or developed.

Retting (turning):
Retting is the process of beginning to separate the bast fibres from the hurds or other plant tissues. This is done in the field, taking advantage of the natural elements of dew, rain, wind and sun, or under controlled conditions using water (most common in China), enzymes or chemicals. The method chosen depends on the end use of the fibre or hurd. To date, suitable industrial processes of water and/or chemical retting have not been developed.

Successful field retting requires a delicate balance of nightly dews and good daytime conditions. Planting date and selection of variety are factors in predicting a suitable harvest date for your region.

The length of the retting process is critical for optimum fibre yield and quality. It normally takes 21-28 days to complete but dry weather and low dew conditions may require longer retting periods. In fact, the process can take as little as 2 weeks.

The “windrows” are turned vigorously once or twice with tines (rakes) to facilitate even retting of the windrow and to knock the leaves off the stems. It is important that the retting process be complete before baling, so that the fibres reach the desired colour and do not rot or discolour in storage. In wet conditions a 3rd turning may be necessary.

Baling and Storage:
Baling can be done with any kind of baler. Large round, soft-core balers may are more satisfactory, allowing bales to fry more quickly in storage. For some industrial processes, the buyer may require a uniform large, square bale, to fit into the processing system however this may present a challenge in preventing spoilage if the bales are stored for later delivery, as square bales are packed more tightly, allowing less air passage than round bales. Note: Sisal or Hemp twine must be used to tie bales because polyester and plastic twines become contaminants in the processing of hemp fibres.

Bales must be stored indoors under dry conditions to stop the retting process before the fibres become rotted. Stalk moisture should be less than 15% at time of baling and should continue to dry to about 10%. Hemp straw also absorbs air moisture quite readily.

Hemp Seed and Fibre Harvesting:
When iHemp is grown for both grain and fibre it is necessary to re-cut the tall stalks after combining. A combine can be modified to perform both functions at the same time by mounting a sickle-bar mower under the header to operate close to the ground.

It is expected that as markets for grain and fibre begin to differentiate dual harvesting will cease to be a common practice. Growers of small acreages will most likely continue to combine and cut stalks as 2 separate operations.

If straw is to be harvested after combining it is important that the weather conditions must also be suitable for drying the stalks for baling.

Combining Seed for iHemp:

Combining iHemp gives a special challenge to both the combine and the operator. In tall varieties large quantities of plant material are put thru the combine. iHemp straw contains very tough fibres that tend to wind around the moving parts. Fine fibres work into bearings, causing friction that can lead to bearing breakdown and combustion. These factors cause heavy machinery wear, high maintenance costs and a great deal of time loss and frustration on the part of the operator. Early grain varieties like “Fedora 19”, “FIN314” and “Fasamo” are shorter and easier to combine.

iHemp seed is harvested when the seed begins to shatter. At this optimum harvest time about 70% of the seeds are ripe at about 22-30% moisture. Later combining increases grain losses due to shattering, bird damage and lower quality grain. Mature fibres tend to wrap more tenaciously around moving parts on the combine.

Raising the cutting blade to about 1 meter (40”) or as high as the header will cut effectively, reduces the amount of material entering the combine. With shorter varieties use a “closer-to-normal” header position. The header knife must be kept sharp at all times to minimise winding of fibres on the sickle bar. Replacing the slatted feeder conveyor with a belt helps reduce the amount of fibre that winds on the feeder shaft. Exterior rotating shafts and pulleys that may come in contact with stalks should be protected when harvesting taller varieties.

Proper setting of the combine improves the yield and quality of the grain and reduces wear on the combine. Experiment with ground speed, concave openings, air and cylinder speeds. For conventional combines use the following:

- 250rpm Cylinder speed
- 1070rpm Fan speed
- ⅛” sieve

- ⅜” chaffer
- Concave set tight

Run feeder housing chain loose in the corn position and close the pre-cleaner. Lower the beater gate, remove the curtains and install a speed-up kit for the beaters. Individual combine operators might find different settings work for their machines. Rotary combines seem to be less satisfactory for harvesting hemp grain because of tendency to plug more readily.

Some “volunteer” hemp (also called “Ditch Weed”) will likely appear in the fall or spring following the iHemp crop. These plants are illegal and must be destroyed before being discovered by local drug enforcement authorities. Thorough cultivation or seedbed preparation is effective.

Contact Us

Industrial Hemp Facts
(*No THC here*)

WOW! Hemp is the miracle plant of our time, breathing in 4*x*the carbon dioxide (CO_2) of trees during it's quick 12-14 week growing cycle. Trees take 20 years to mature vs 4 months for Industrial Hemp! Our forests are being cut down 3x faster than they can grow! One acre of hemp produces as much cellulose fiber pulp as 4.1 acres of trees!!! (*Dewey & Merrill. Bulletin #404. U.S. Dept. of Age. 1916*)

1807: Napoleon signs Treaty with Russia to cut off all legal Russian Hemp trade with Britain. but the Czar refuses to enforce the treaty and turns a blind eye to Britain's illegal Hemp trade.

June 24th, 1812 Napoleon invades Russia to try and put an end to Britain's main supply of Russian Hemp but by the end of the year the Russian winter had decimated most of Napoleon's forces. Did you know that the Royal Navy relied on Russian Hemp to stay afloat during their war with the U.S.? (the War of 1812)

View this ***video of Henry Ford's plastic car,*** built to help American farmers by using cellulose grown on the land, such as southern slash pine fiber, straw, ramie and HEMP. This plastic car comprised 70% cellulose with 30% resin binder. On his large estate, Ford was photographed among his hemp fields. The car, 'grown from the soil' had an impact strength 10 times stronger than steel at 2/3 rd's the weight for better economy (Popular Mechanics, 1941) Alcohol prohibition prevented Mr. Ford from powering his fleet with "plant-power".

Why is it still illegal to grow hemp in the United States of America when many other industrialized nations have embraced the many economic uses & benefits of industrial, non-cannabis hemp? It's only a matter of time before hemp becomes a mainstay of our economy & helps to clean up our environment.

* Hemp sails & rope carried Columbus to the Americas in 1492. Columbus boat carried hemp seed for use in case of shipwreck to grow crops for raw materials & as a source of nutrition.

* George Washington, Thomas Jefferson and other founding fathers GREW HEMP; (*Washington and Jefferson Diaries*). Jefferson smuggled hemp seeds from China to France then to America. Hemp was in such demand in the colonies that taxes could be paid in hemp & fines were levied against farmers who did not grow hemp!

* Benjamin Franklin owned one of the first paper mills in America and it processed hemp. Also, the War of 1812 was fought over hemp. Napoleon wanted to cut off Moscow's export to England (*Emperor Wears No Clothes, Jack Herer).*

* For thousands of years, 90% of all ships' sails and rope were made from hemp. The word 'canvas' is Dutch for cannabis; (Webster's New World Dictionary).

* 80% of all textiles, fabrics, clothes, linen, drapes, bed sheets, etc. were made from hemp until the 1820s with the introduction of the cotton gin.

* Until 1883 more than 3/4 of the world's paper was made from hemp fiber. Hemp crops produce nearly 4 times as much raw fiber than equivalent tree plantations! Hemp paper is finer, stronger & lasts longer than wood-based papers. Bank notes & archival papers are made from hemp paper.

The first Bibles, maps, charts, Betsy Ross's flag, the first drafts of the Declaration of Independence and the Constitution were made from hemp (*U.S. Government Archives)*.

* The first crop grown in many states was hemp. 1850 was a peak year for Kentucky producing 40,000 tons. Hemp was the largest cash crop until the 20th Century; (*State Archives*).

* Oldest known records of hemp farming go back 5000 years in China. For more than 1000 years before the time of Christ until 1883 AD Cannabis Sativa was our planet's most important industry for thousands of products & enterprises producing the overall majority of the earth's fiber, fabric, lighting oil, incense, fiberglass replacement, lightweight sandwich boards, composite

woods, kitty litter, potting mix, nappies, feminine care products, fuel, medicines & paper, as well as a primary source of protein for humans & animals.

* Rembrandts, Gainsboroughs, Van Goghs as well as most early canvas paintings were principally painted on hemp linen.

*** In 1916, the U.S. Government predicted that by the 1940s all paper would come from hemp and that no more trees need to be cut down. Government studies report that 1 acre of hemp equals 4.1 acres of trees. Plans were in the works to implement such programs (Department of Agriculture).**

* Quality paints and varnishes were made from hemp seed oil until 1937. 58,000 tons of hemp seeds were used in America for paint products in 1935; (*Sherwin-Williams Paint Co. testimony before Congress against the 1937 Marijuana Tax Act)*.

The 1937 Marihuana Tax Act of 1937placed a tax on the sale of Cannabis. The Act was drafted by Henry Anslinger and introduced by Rep. Robert L. Doughton(D) of North Carolina on April 14, 1937.

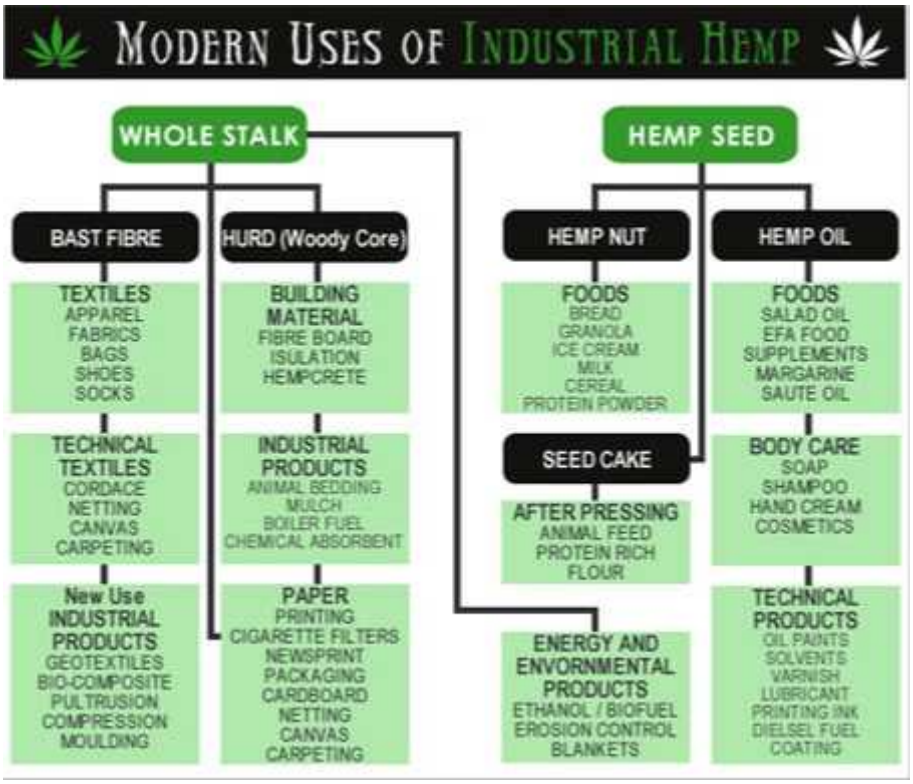
* Hemp called 'Billion Dollar Crop.' It was the first time a cash crop had a business potential to exceed a billion dollars (*Popular Mechanics, Feb., 1938)*.

* Mechanical Engineering Magazine (*Feb. 1938*) published an article entitled 'The Most Profitable and Desirable Crop that Can be Grown.' It stated that if hemp was cultivated using 20th Century technology, it would be the single largest agricultural crop in the U.S. and the rest of the world.

* Hemp is fully international: "Canamo" in Spanish, "Chanvre" in French, "Konoplya" in Russian, "Hanf" in German, "Kender" in Hungarian, "Tai Ma" in Chinese, "Cinepa" in Romanian.

Everybody knows the Japanese currency, the yen (¥). In Japanese it is pronounced en and it's kanji also means circle, or round. There is an anecdote that this fact prompted U.S. General McArthur to set the initial yen-dollar exchange rate at 360 yen to the dollar, for there are 360 degrees in a circle. True or not, the Yen are called what they are called because they literally used to be circles with a hole in the middle, just like a washer. In fact two of the yen coins in circulation today, the 5 yen and 50 yen coins are still like that. The reason for the hole is that coins used to be lined up on **hemp** strings and carried around like that. In historic Japan (as in China before) everybody's wallet used to be a piece of hemp, the most durable and trusted natural fibre known to man.

* The Chernobyl Nuclear Plant Reactor 4 in the Ukraine caused severe radioactive contamination in April 1986. Industrial Hemp has been used to remove contaminants from the soils, called phytoremediation.



Hemp cultivation and production do not harm the environment. The USDA Bulletin #404 concluded that hemp produces 4 times as much pulp with at least 4 to 7 times less pollution. (*Popular Mechanics, Feb. 1938*).

Consider a few more facts about hemp:

- Hemp does not require herbicides or pesticides.
- Hemp can be grown in a wide range of latitudes and altitudes.
- Hemp replenishes soil with nutrients and nitrogen, making it an excellent rotational crop.
- Hemp controls erosion of the topsoil.
- Hemp converts CO_2 to oxygen better than trees.
- Hemp produces more oil than any other crop, which can be used for food, fuel, lubricants, soaps, etc.
- Hemp nut is a very healthy food, being the highest protein crop (after soybean) and high in omega oils.
- Hemp can be used for making plastics, including car parts.
- Hemp makes paper more efficiently and ecologically than wood, requiring no

chemical glues.
• Hemp can be used to make fiberboard.
• Hemp can be used to make paint.
• Hemp can produce bio-fuel and ethanol (better than corn).
• Hemp can be grown more than once per year.
• Hemp fibers can make very strong rope and textiles.

You can also read the whole chronology of Industrial Hemp atHemphasis

Another interesting read is this article written by Earnest
Small & David Marcus:

Hemp is a distinct variety of the plant species *Cannabis sativa L.* that grows to a height anywhere from 4-15 ft (1.2-4.5 m) and up to 0.75 in (2 cm) in diameter. The plant consists of an inner layer called the pith surrounded by woody core fiber, which is often referred as hurds. Bast fibers form the outer layer. The primary bast fiber is attached to the core fiber by pectin—a glue-like substance. The primary fibers are used for textiles, cordage, and fine paper products. The wood-like core fiber is used for animal bedding, garden mulch, fuel, and an assortment of building materials.

Due to the similar leaf shape, hemp is frequently confused with marijuana, another cannabis plant. The major difference is their tetrahydrocannabinol (THC) content, the ingredient that produces the high when smoked. Marijuana can contain as much as 20% THC, compared to less than 1% for industrial hemp. Despite this difference, some countries are reluctant to legalize growing of hemp (especially the United States), since there is a fear this will make it more difficult to control the use of the drug. Most hemp varieties also have a hollow stalk that have a very high fiber content (35%), in contrast to marijuana varieties that usually have a solid stalk having low fiber content (15%).

Canada is one country that has legalized hemp, though with certain restrictions. The maximum allowable THC concentration is 0.3% and all hemp farmers are required to undergo a criminal-records check, as well as obtain a license from Health Canada. Despite these restrictions, hemp production has increased threefold in just a year, from 6, 175 acres (61.75 hectares) harvested in 1998 to nearly 20,000 acres (200 hectares) in 1999. Over 95% of the acres grown in 1999 in Canada were for hemp grain.

Farmers who grow hemp claim it is a great rotation crop and can be substituted for almost any harvest. It grows without requiring pesticides and is good at aerating the soil. On a per-acre basis, one estimate claims hemp nets farmers more income ($250-$300) than either corn or soybeans ($100-$200). A full crop of hemp only takes 90 days to grow, yielding four times more paper per acre, when compared over a similar 20 year period with redwood trees in the northwest United States. However, there are other varieties of trees that yield two to three times more than hemp.

Advocates of hemp claim that it can be used in 25,000 different products, from clothing to food to toiletries. Until the nineteenth century, hemp was used in 90% of ships' canvas sails, rigging, and nets (and thus it was a required crop in the American colonies). Today, hemp fiber is being used as a replacement for fiberglass in automotive components and made into cloth for window dressings, shower curtains, and upholstery. China is the world's largest producer of hemp fabric, whereas India produces the most hemp overall.

Other products made from hemp fiber include: insulation, particleboard, fiberboard, rope, twine, yarn, newsprint, cardboard, paper, horse stable bedding, and compost. Hemp bedding has been found superior to straw and other materials for horse stalls in reducing the smell of ammonia. Hemp seed is used to make methanol and heating oil, salad oil, pharmaceuticals, soaps, paint, and ink.

Currently 32 countries, including Canada, Great Britain, France, and China, allow farmers to grow industrial hemp. The current hemp market for sales and exports in North America is estimated at between $50-$ 100 million per year. Unites States imports of industrial woven fabrics made from hemp totaled $2.9 million in 1997. Import volume jumps to around $40 million when other products—such as paper, shampoo, and oil—are included. Textile uses of hemp represent 5% of hemp products produced in Canada.

History

Hemp was the first plant to be domestically cultivated around 8000 B.C. in Mesopotamia (present-day Turkey). Hemp was grown for fiber and food. It was recorded as being harvested in central Asia around 6500 B.C. Several centuries later, China started growing hemp as a crop and later used it in medicine. By 2700 B.C., the Middle East, Africa, and most of Asia used hemp for fabric, rope, medicine, and food. Hemp was introduced to Europe 400 years later. The oldest surviving piece of paper, a 100% Chinese hemp parchment, was dated to A.D. 770.

From 1000 B.C. to the nineteenth century, hemp was the world's largest agricultural crop, where it was also used for paper and lamp oil. During this period, several well-known books, including the Bible and *Alice in Wonderland,* were printed on hemp paper, and several famous artists painted on hemp canvas. The first crop in North America was planted by a French botanist in Nova Scotia in 1606. Thomas Jefferson drafted the United States Declaration of Independence on hemp paper and grew hemp him-self. Two centuries later, the United States and Canada put a stop cannabis cultivation in 1937 with the Marijuana Tax Act (this put a one dollar per ounce tax on any hemp manufacturers), which was later lifted during the World War II effort.

Global production of hemp has been declining since the 1960s, from over 300,000 short tons (272,160 t) of hemp fiber and tow in 1961 to 69,000 short tons (62,597t) in 1997. China accounts for 36% of this production and 73% of grain production. This has dropped from 80,000 to 37, 000 short tons (72,576 to 33,566 t) over the same period. Around 1994, there were 23 paper mills using hemp fiber, at an estimated world production of 12,000 short tons (10,886 t) per year. Most of these mills were located in China and India for producing printing and writing paper. Others produced specialty papers, including cigarette paper. The average hemp pulp and paper mill produces around 5,000 short tons (4,536 t) per year, compared to wood pulp mills at 250,000 short tons (226,800t) per year.

However, in the last decade, the number of companies trading in and manufacturing hemp products has increased dramatically. The North America market is still in its infancy since Canada just legalized hemp production and sale in 1998. Hemp cultivation tests in the United States began a year later though it is still illegal to grow it commercially.

Raw Materials

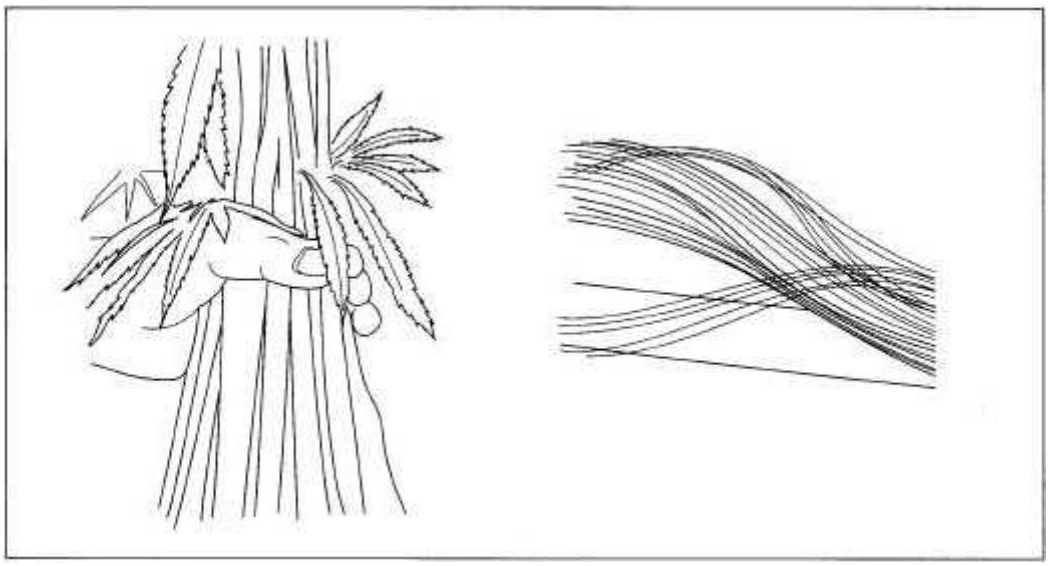
Fiber processing uses few chemicals, if any at all. However, the fiber may be blended with other materials, such as synthetic fibers or resins as binders, depending on the final product being made. For paper making, water and chemicals (sodium hydroxide or sulfur compounds) are mixed with the fibers to remove the natural glue components.

The Manufacturing Process

Cultivation and harvesting

Hemp is an annual plant that grows from seed. It grows in a range of soils, but tends to grow best on land that produces high yields of corn. The soil must be well drained, rich in nitrogen, and non-acidic. Hemp prefers a mild climate, humid atmosphere, and a rainfall of at least 25-30 in (64-76 cm) per year. Soil temperatures must reach a minimum of 42-46°F (5.5-7.7°C) before seeds can be planted.

- 1 The crop is ready for harvesting high quality fiber when the plants begin to shed pollen, in mid-August for North America. Harvesting for seed occurs four to six weeks later. Fiber hemp is normally ready to harvest in 70-90 days after seeding. A special machine with rows of independent teeth and a chopper is used. To harvest hemp for textiles, specialized cutting equipment is required. Combines are used for harvesting



An example of hemp and hemp fibers.

grain, which are modified to avoid machine parts being tangled up with bast fiber.

- 2 Once the crop is cut, the stalks are allowed to rett (removal of the pectin [binder] by natural exposure to the environment) in the field for four to six weeks—depending on the weather—to loosen the fibers. While the stalks lay in the field, most of the nutrients extracted by the plant are returned to the soil as the leaves decompose. The stalks are turned several times using a special machine for even retting and then baled with existing hay harvesting equipment. Bales are stored in dry places, including sheds, barns, or other covered storage. The moisture content of hemp stalks should not exceed 15%. When planted for fiber, yields range from 2-6 short tons (1.8-5.4t) of dry stalks per acre, or from 3-5 short tons (2.7-4.5 t) of baled hemp stalks per acre in Canada.

Grain processing

- 3 Hemp seeds must be properly cleaned and dried before storing. Extraction of oil usually takes place using a mechanical expeller press under a nitrogen atmosphere, otherwise known as mechanical cold pressing. Protection from oxygen, light, and heat is critical for producing a tasty oil with an acceptable shelf-life. Solvent extraction methods are also emerging for removing oil since they achieve higher yields. Such methods use hexan, liquid carbon dioxide, orethanol as the solvent. Refining and deodorizing steps may be required for cosmetics manufacturers.
- 4 A dehulling step, which removes the crunchy skin from the seed using a crushing machine, may be required. Modifications to existing equipment may be required to adequately clean the seeds of hull residues.

Fiber processing

- 5 To separate the woody core from the bast fiber, a sequence of rollers (breakers) or a hammermill are used. The bast fiber is then cleaned and carded to the desired core content and fineness, sometimes followed by cutting to size and baling. After cleaning and carding, secondary steps are often required. These include matting for the production of non-woven mats and fleeces, pulping (the breakdown of fiber bundles by chemical and physical methods to produce fibers for paper making), and steam explosion, a chemical removal of the natural

binders to produce a weavable fiber. Complete processing lines for fiber hemp have outputs ranging from 2-8 short tons/hour (1.8-7.2 t/hr).

Packaging

- 6 The primary fiber is pressed into a highly compressed bale, similar to other fibers like **cotton,** wool, and polyester. Other products, such as horse bedding, are packaged in a compressed bale.

Paper making

- 7 Bast fibers are usually used in paper, which are put into a spherical tank called a digester with water and chemicals. This mixture is heated for up to eight hours at elevated temperature and pressure until all fibers are separated from each other. Washing with excess water removes the chemicals and the extracted binding components (pectin). The clean fibers are then fed into a machine called a Hollander beater, which consists of a large tub equipped with a wheel revolving around a horizontal axis. This beating step, which lasts for up to 12 hours, cuts the fibers to the desired length and produces the required surface roughness for proper bonding. Bleaching chemicals are sometimes added during this step or to separate tanks with the fibers. The bleached pulp is then pumped to the paper machine or pressed to a dryness suitable for transportation to a paper mill at another location.

Quality Control

Hemp fibers are tested for tensile strength, fineness (fiber diameter), and the color is recorded. Moisture content is recorded during every stage of the growing and production process. The THC content of the plant is also contiguously tested to make sure that the level does not exceed the 0.3% mark. Research is still being conducted on the effects that hemp would have on the industry. Set standards are constantly being altered and changed.

Byproducts/Waste

The harvested hemp not used is burned. During fiber processing, the core fiber is saved and usually used to make paper, horse bedding, or construction materials. Most hemp producers recycle the core fiber by removing dust, then baling and packaging. The dust can be pressed into pellets used for fuel. The dirt and small chips of core are also used as a high nutrient soil additive.

The Future

Where it is legal, the hemp industry has been growing at an annual growth rate of 20%. Other potential uses are being developed. For instance, hemp meal has demonstrated it can be used as a food ingredient for aquiculture farms, specifically freshwater fish and shrimp. Even hemp beer has entered the Canadian market, though it is expected to remain a small part of beer sales. Composite materials for the building industry are also being investigated.

Using hemp as a source of food may become the largest application, since hemp seeds have much nutritional value. The seed contains essential fatty acids, protein, calcium, iron, zinc, and vitamins B, C, and E. Hemp seed can be made into oil or flour and can also be eaten whole, since it tastes similar to pine nuts or sunflower seeds.

The outlook for hemp in the United States is uncertain since it is still illegal to grow it. There are 10 states that passed legislation in 1998 to allow growing hemp for research purposes—Arkansas, California, Hawaii, Illinois, Minnesota, Montana, New Mexico, North Dakota, and Virginia—and a number of other states are considering it. However, federal law still prohibits growing industrial hemp. The Drug Enforcement Agency will have to change its mind before any market can be developed in the United States. Once that happens, hemp could become a billion dollar crop if there is enough investment and interest, prices are competitive, and high quality products can be made. Processing technology also needs to be upgraded for higher value-added products.

Where to Learn More

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