A CASE FOR PENNSYLVANIA

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KNOW THE DIFFERENCE

INDUSTRIAL HEMP, COMMERCIAL HEMP, HEMP CBD, CANNABIDOIL, CANNABIS, CANNABIS SATIVA L., HEMP OIL, ARE ALL TERMS RAISED DURING THE DISCUSSION TO REINTRODUCE THE HEMP CROP TO PENNSYLVANIA. THE ONGOING DIALOGUE ACROSS THE COMMONWEALTH HAS CONVOLUTED THIS PLANT SPECIES AND USES.

HEMP

Industrial or Commercial Hemp is a sustainably farmed crop and has many uses including paper, textiles, biodegradable plastics, construction, health food, insulation, auto parts and components and fuel. Industrial/Commercial Hemp is grown in many countries. Canada's $2 BILLION Hemp industry exports $650 Million annually into the United States. Pennsylvania led this industry nationally until politics and money had it being banned. 10 States have approved, 15 considering.

← 0.3% THC*, <u>NO HIGH</u>

MARIJUANA

High THC* Marijuana (or marihuana) A sister plant to Industrial Hemp. Cannot be grown near Industrial Hemp, cross-pollination depletes THC*.

Is used legally, medically, recreationally and illegally across America for pain, seizure and appetite management and, for the "High" that it produces. Has NO industrial use. Grown in greenhouses for medical and recreational sale.

UP TO 34% THC*

CBD (Cannabidoil): US Patent US6630507 B1 is a natural occurring element – is antioxidant, anti-inflammatory Omega 3&6

***THC**– (Tetrahydrocannabinol) Produces a psychotropic effect

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Introduction and Overview

Industrial hemp (Cannabis sativa) is one of the oldest cultivated plants in the world. For centuries, its fibers have been used to make ropes, sails and clothing.

Hemp is often confused with marijuana. Both are forms of the plant cannabis sativa. Both naturally contain CBD (Cannabidiol) accounting for up to 40% of the plant's extract and Delta-9-Tetrahydrocannabinol (THC). But what separates the two is their intoxicating effect. THC is the active ingredient in marijuana that makes its users intoxicated. Marijuana, depending on the strain, can contain 1-35% THC, whereas hemp's THC content is about .01 -.03 % essentially rendering it useless for anything psychotropic. They are also grown in two completely different ways, and cannot be grown together.

Hemp production originated in Central Asia thousands of years ago. The plant is one of the oldest sources of textile fiber. Fibers from hemp have been found in pottery dating back over 7,000 years. For more than a century in the United States folks lit their lamps and clothed themselves with hemp. Our own forefathers were fans of hemp. Both George Washington and Thomas Jefferson cultivated the plant on their farms. Ben Franklin started the first American paper mill which exclusively used hemp. Even the Declaration of Independence was drafted on hemp paper. Hemp rivaled flax as the main textile fiber until the middle of the 19th century.

The crop was first brought to North America at Port Royal, Canada, in 1606. Industrial hemp was the most important non-food crop in the early history of the United States, being used for sails, riggings, canvas, ropes, clothing and paper. Its diverse uses made it a required crop, for a farmer's and for the country's existence.

In Pennsylvania, particularly the farming communities of York and Lancaster counties, hemp was very big business. Due to their proximity to the Susquehanna River these two counties became the epicenter for hemp growing in Pennsylvania. Every township in Lancaster grew hemp, particularly ***Hemp****field Township*. Between 1720 and 1870 there were more than 100 mills in Lancaster County that processed hemp fiber. That fiber was used to help cover many Conestoga wagons, which were built in the small town of Conestoga, Pennsylvania. The folks at the Landis Valley Museum are helping to raise awareness. They have several historical hemp stones placed on their property, and are also in plans to develop an exhibit on the historical uses of hemp in the county. They feel the re-growing of hemp will help also with struggling farmers and boost tourism in the area.

Nationally, the hemp industry thrived in Kentucky, Missouri and Illinois between 1840 and 1860 because of the strong demand for sailcloth and cording. From then until World War I, nearly all hemp in the United States was produced in Kentucky. During the war, some hemp cultivation occurred in Kentucky, California and most Midwestern states. During most of this time and up until the 1940, documents referred to the product as *"Indian Hemp".* It was another Pennsylvanian, Altoona resident Harry J. Anslinger, as the first commissioner of the U.S. Treasury Department's Federal Bureau of Narcotics that lead the campaign against Indian Hemp. Anslinger has been accused of being responsible for racial themes in articles against marijuana in the 1930s. "By the tons it is coming into this country — the deadly, dreadful poison that racks and tears not only the body, but the very heart and soul of every human being who once becomes a slave to it in any of its cruel and devastating forms…. Marihuana is a short cut to the insane asylum. Smoke marihuana cigarettes for a month and what was once your brain will be nothing but a storehouse of horrid specters. Hasheesh makes a murderer who kills for the love of killing out of the mildest mannered

man who ever laughed at the idea that any habit could ever get him". Some of his critics allege that Anslinger and the campaign against Indian Hemp and marijuana had a hidden agenda. DuPont petrochemical interests and William Randolph Hearst together created the highly sensational anti-marijuana campaign to eliminate hemp as an industrial competitor.

With the passage of the Marihuana Tax Act in 1938, hemp production in the United States essentially ended. World War II led to a brief revival of hemp cultivation in the Midwest, due in part by the requirement of the Department of Agriculture that farmers grow it because the fiber was in short supply to produce rope, boots, uniforms and parachute cording.

As hemp's use declined, so did the loyalty to the crop. This decline allowed for even more confusion between the values of industrial hemp versus the problems associated with its similarity to marijuana.

In the 1950s, domestic opposition concluded in anti-drug legislation that made it illegal to raise **any** cannabis plant varieties. This total eradication of the crop was designed to improve drug enforcement of illegal marijuana production. During this time, all hemp became classified as a "drug" under the Controlled Substance Act and subsequently placed control of hemp production under the control of the U.S. Drug Enforcement Administration (DEA) rather than the U.S. Department of Agriculture (USDA). Today, some 50 years later, our Federal government spends $millions annually to eradicate hemp, Indian Hemp or ditch weed, which has been growing from the seeds of the original 1930's hemp plants which naturally reseeds itself and grows along railroads and highways.

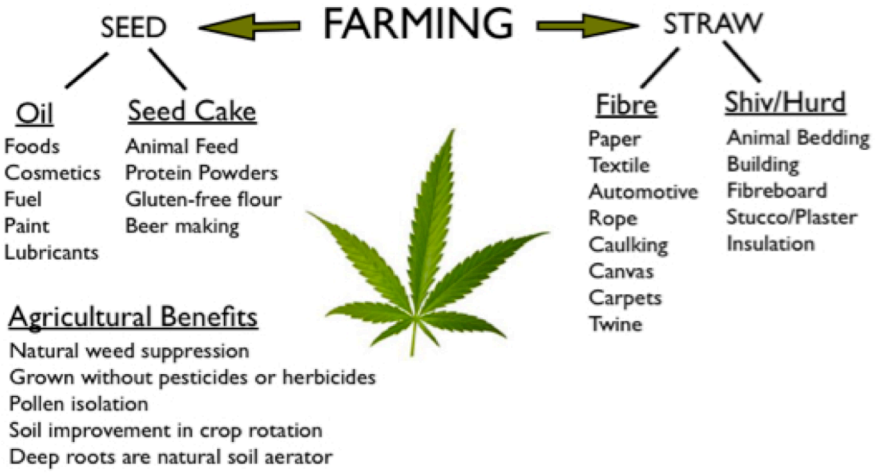
We're down to 1% of Americans farming; this figure was 30% higher when our world-leading hemp industry was stymied in 1937. The crop is more valuable today than ever before. American farmers have been watching as Canadian farmers clear huge profits from hemp: $250 per to as much as $2,000.00 per acre in 2013. By comparison, South Dakota State University predicted that soy, a major crop, will net U.S. farmers $71 per acre in 2014.

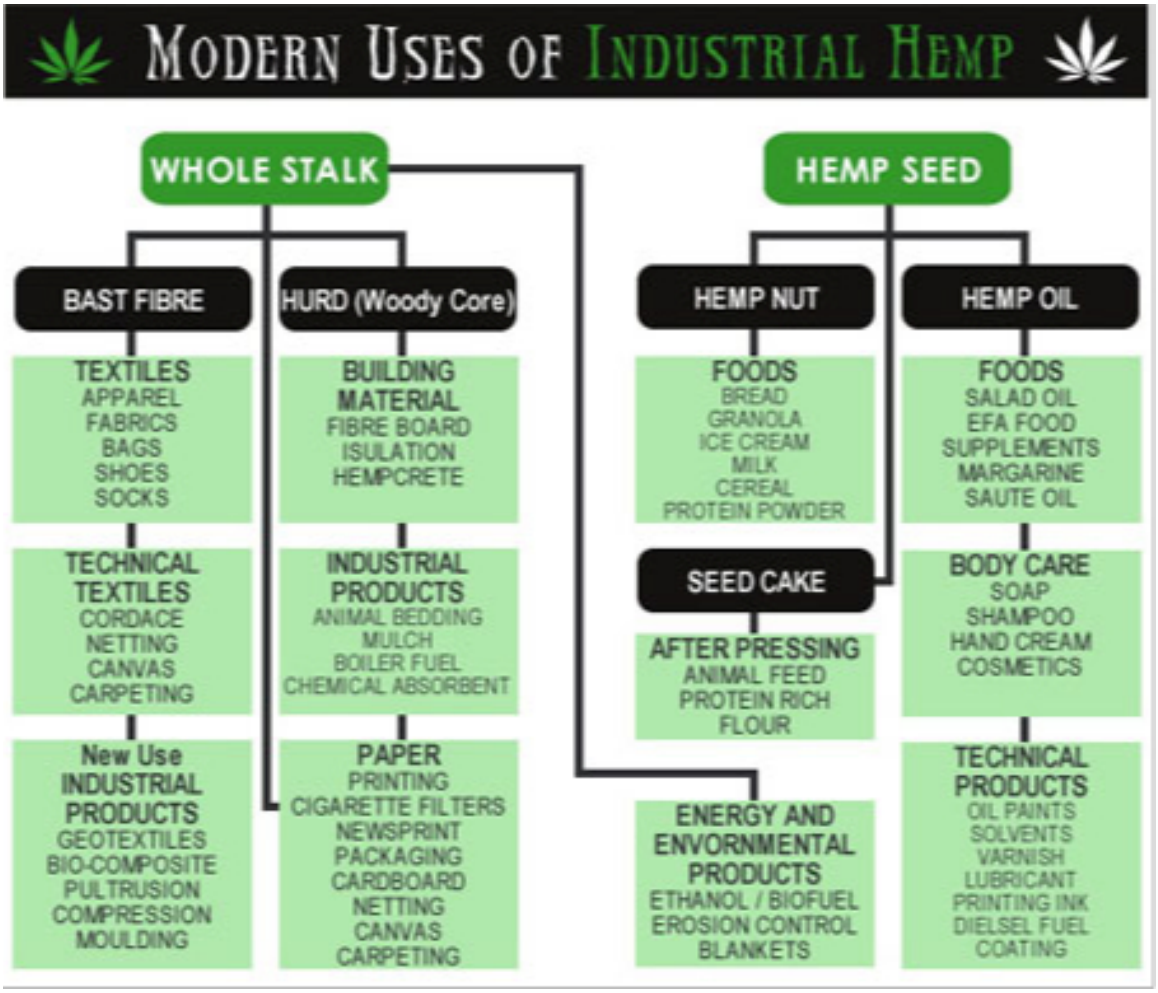
Now, with the big movement in the industrialized world toward becoming more environmentally friendly, many are standing up for the re-legalization of hemp. It offers great alternatives to petroleum, plastic, cotton, and pulpwood. 31 countries currently grow industrial hemp. New manufacturing technologies, crop diversification, increased wood products usage and the development of synthetics all aided in the decline of hemp production. It too is now a leading component for the automotive and construction industries. With the demand for lighter weight, hybrid and electric vehicles, auto suppliers and manufacturers are now making door panels and components from hemp. Hempcrete is one of the largest growing components of building foundations in Europe and a variation of industrial hemp is being used as insulation.

Modern uses grow, with over 25,000 products being produced from hemp. Sustainable hemp seed, fiber and oil are still used in raw materials by major companies, including Ford Motors, Patagonia, and The Body Shop, to make a wide variety of products. However, most hemp product manufacturers are forced to import hemp seed, oil and fiber from growers in Canada, Europe, and China because American farmers are prohibited by law from growing this low-input sustainable crop. More than $550 Million dollars of hemp products are imported into the United States annually. You can walk on hemp, wear it, wash with it, and eat it in cereals, pretzels, mustards, milk and supplements. Most bird's seed mixes contain hemp and it can be used as a feedstock. The entire plant is usable. It is anti fungal, resists mold and mildew and can be grown chemical free. If fact, most industrial hemp is grow organically.

Benefits of Hemp-Lime in construction:

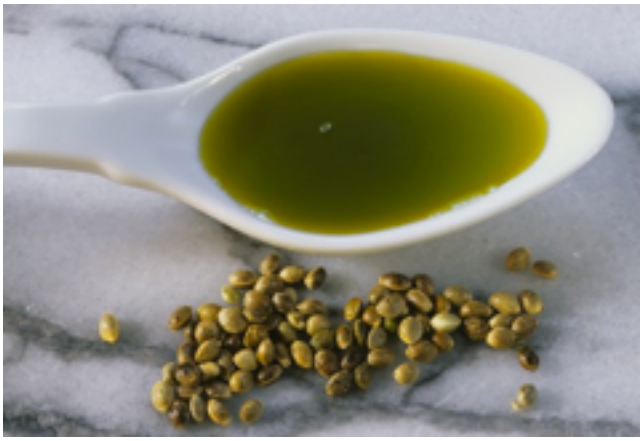
Thermal Mass Insulation
Negative Carbon (>6lbs/cubic foot)
Low Density
Clean Air
High Thermal Resistance (R-Value = 2.5 - 3.0 per inch)
High Thermal Inertia
Vapour Permeable (breathable) (>2 gm/M2/mm)
Design Flexibility (adjustable thickness)
Fire and Pest Resistant (NO Termites)
Significantly Reduce Co2 Emissions (.545kg/kWh)
Inherently Airtight (<2: m3/m2 hr @ 50 pa)
No Waste (re-build or fertilise)
No Mould (lime is highly alkaline)
No Termites
No Dry Rot
Natural Substrates for Plasters and Renders
Low Air Infiltration (.75 gm/m2/mm hg)
ZERO LAND FILL





Hemp materials contribute to the BMW i3's natural looking interior.

Hemp Automotive Door Panels contribute to lighter weight, fuel efficient electric vehicle mileage



Hemp contains Omega 3, 6 fatty acids

The Path to Federal Reintroduction

In 2005, for the first time since the federal government outlawed hemp farming in the United States, a federal bill was introduced that would remove restrictions on the cultivation of non-psychoactive industrial hemp. At a Capitol Hill lunch on June 23, 2005 marking the introduction of H.R. 3037, the "Industrial Hemp Farming Act of 2005," Congressional staffers were treated to a delicious gourmet hemp lunch while listening to various prominent speakers tout the myriad benefits of encouraging and supporting a domestic hemp industry.

The bill was written with the help of Vote Hemp by chief sponsor Rep. Ron Paul (R-TX), and it garnered 11 additional cosponsors. The bill defined industrial hemp, excluded it from the definition of "marihuana" in the Controlled Substances Act, and assigned authority over it to the states, allowing laws in those states regulating the growing and processing of industrial hemp to take effect.

On February 13, 2007 Rep. Ron Paul introduced H.R. 1009, the "Industrial Hemp Farming Act of 2007," with nine original cosponsors. The bill was assigned to committee, but never received a hearing or a floor vote. At the end of the 110th Congress the bill had 13 cosponsors.

On April 2, 2009 Rep. Ron Paul introduced H.R. 1866, the "Industrial Hemp Farming Act of 2009," with ten original cosponsors. The bill was assigned to committee, but never received a hearing or a floor vote. At the end of the 111th Congress the bill had 25 cosponsors.

On May 12, 2011 Rep. Ron Paul introduced H.R. 1831, the "Industrial Hemp Farming Act of 2011," with twenty-two original cosponsors. The bill was assigned to committee, but never received a hearing or a floor vote. At the end of the 112th Congress Rep. Ron Paul and Rep. Barney Frank retired and the bill had 37 cosponsors. A Senate companion bill was introduced on August 2, 2012 by Sen. Ron Wyden.

On June 7, 2012 Sen. Ron Wyden introduced S.AMDT.2220, industrial hemp to the Farm Bill. This amendment failed to be attached to the 2012 Farm Bill, but did help to find original cosponsors for the introduction of S. 3501, the "Industrial Hemp Farming Act of 2012." The Farm Bill was passed by the Senate, but failed to be passed by the House. The Farm Bill will need to be revisited in the 113th Congress.

May 20, 2013 Sen. Ron Wyden introduced S.AMDT.952, industrial hemp to the 2013 Farm Bill. This amendment failed to be attached to the Farm Bill, but did help to find original cosponsors for the introduction of S. 3501, the "Industrial Hemp Farming Act of 2012."

The Farm Bill of 2014

Originally introduced by Rep. Polis (D-CO), Rep. Massie (R-KY) and Rep. Blumenauer (D-OR), the amendment allows State Agriculture Departments, colleges and universities to grow hemp, defined as the non-drug oilseed and fiber varieties of Cannabis, for academic or agricultural research purposes, but it applies only to states where industrial hemp farming is already legal under state law. Industrial Hemp is not legal in Pennsylvania.

Sen. McConnell (R-KY) successfully worked to retain and strengthen the hemp research amendment during the Farm Bill conference committee process.

"With the U.S. hemp industry estimated at over $500 million in annual retail sales and growing, a change in federal law to allow colleges and universities to grow hemp for research means that we will finally begin to regain the knowledge that unfortunately has been lost over the past fifty years," says Vote Hemp President Eric Steenstra.

"This is the first time in American history that industrial hemp has been legally defined by our federal government as distinct from drug varieties of Cannabis," Steenstra continued. "The market opportunities for hemp are incredibly promising—ranging from textiles and health foods to home construction and even automobile manufacturing. This is not just a boon to U.S. farmers, this is a boon to U.S. manufacturing industries as well."

So far in the 2014 legislative season, industrial hemp legislation has been introduced or carried over in thirteen states: Arizona, Hawaii, Indiana, Mississippi, Nebraska, New Jersey (carried over from 2013), New York, Oklahoma, South Carolina, Tennessee, Washington (two bills carried over from 2013), West Virginia and Wisconsin.

In addition to the Farm Bill amendment, two standalone industrial hemp bills have been introduced in the 113th Congress so far. H.R. 525, the "Industrial Hemp Farming Act of 2013," was introduced in the U.S. House on Feb. 6, 2013, and the companion bill, S. 359, was introduced in the U.S. Senate soon thereafter on Feb. 14, 2013. The bills define industrial hemp, exclude it from the definition of "marihuana" in the Controlled Substances Act (CSA), and give states the exclusive authority to regulate the growing and processing of the crop under state law. If passed, the bills would remove federal restrictions on the domestic cultivation of industrial hemp.

To date, thirty-two states have introduced pro-hemp legislation and twenty have passed pro-hemp legislation. Ten states (California, Colorado, Kentucky, Maine, Montana, North Dakota, Oregon, Vermont, Washington and West Virginia) have passed industrial hemp farming laws and removed barriers to its production. These states will be able to take immediate advantage of the industrial hemp research and pilot program provision, Section 7606, of the Farm Bill.

Three states (Hawaii, Kentucky and Maryland) have passed bills creating commissions or authorizing research. Nine states (California, Colorado, Illinois, Montana, New Hampshire, New Mexico, North Dakota, Vermont and Virginia) have passed resolutions. Finally, eight states (Arkansas, Illinois, Maine, Minnesota, New Mexico, North Carolina, North Dakota and Vermont) have passed study bills. However, despite state authorization to grow hemp, farmers in those states still risked raids by federal agents, prison time, and property and civil asset forfeiture if they plant the crop, due to the failure of federal policy to distinguish non-drug oilseed and fiber varieties of Cannabis (i.e., industrial hemp) from psychoactive drug varieties (i.e., "marihuana").
The Tennessee Department of Agriculture is looking for a few farmers interested in growing industrial hemp. Applications are now open for farmers and producers to work with department in the production of industrial hemp. The Tennessee General Assembly last year passed a law that legalized strains of low-THC varieties of cannabis, as well as the measure to start a licensing program.

Congress knows the farm bill hemp provision is just a baby step. The real solution is the Industrial Hemp Farming Act, introduced by Sen. Ron Wyden (D-Ore.), which would allow nationwide commercial hemp cultivation. Colorado, already ahead of federal law on legalizing psychoactive cannabis, is also in front on hemp; it has a state law allowing commercial hemp cultivation. At least 1,600 acres were planted this season.

Hemp as a Nutritional Supplement and CBD Extract

The nutritional properties of hemp comes in three different ways: **hemp seeds**, hemp oil, and hemp **protein**. **Hemp seeds**: These little seeds give the complete nutritional power of hemp with their blend of omega-3 and omega-6 fats, high fiber content, and quality amino acid profile.

In addition oils extracted from hemp have also proven to help people who suffer from a wide range of neurological disorders. As a result of this wide spread fact a bipartisan bill introduced in the House of Representatives on July 28, 2014, by Pennsylvania Congressman Perry (R-PA-4) would legalize a compound in hemp used to treat severe epilepsy.

The legislation, called the "Charlotte's Web Medical Hemp Act of 2014," would exclude "therapeutic hemp" and "cannabidiol," or CBD, a non-psychoactive compound extracted from hemp, from the definition of marijuana in the Controlled Substances Act. Therapeutic hemp and CBD, is illegal under current federal law.

The bill, co-sponsored by Reps. Scott Perry (R-Pa.), Steve Cohen (D-Tenn.) and Paul Broun (R-Ga.), says therapeutic hemp and CBD "shall not be treated as controlled substances."

"This bill in no way changes my stance on marijuana -- I still disagree with the recreational use of marijuana," Perry said in a statement. "However, these children and individuals like them deserve a chance to lead a healthy and productive life and our government shouldn't stand in the way."

The bill takes its name from 7-year-old Charlotte Figi, a Colorado girl with a rare form of epilepsy called Dravet syndrome. Her parents are successfully treating her debilitating seizures with a strain of high-CBD, low-THC medical cannabis called "Charlotte's Web." Traditional pharmaceuticals failed to help.

The introduction of the House bill comes after 11 states have legalized CBD for limited medical use or research. To date, 23 other states have more broadly legalized medical marijuana. But because federal law considers all forms of marijuana illegal, people who use, possess, sell or grow marijuana for medical use -- even in states where it's legal -- face potential federal charges.

Some have argued that CBD-specific legislation, like the new House bill, is too narrow and should be expanded to include marijuana for all medical uses.

"We fully understand that, and are pushing for" full legalization of medical marijuana, Figi said. "But with politicians, you negotiate down to what they are comfortable with and what will or will not pass. How do you stand by and say we're not going to help anybody?"
Figi said the Realm of Caring has about 14,000 patients on its waiting list for epilepsy treatment with Charlotte's Web. "It's so painful to see people waiting and dying," she said. "My friends -- the Conte family -- just lost their daughter in New York. They fought for New York's medical marijuana law and she's probably the reason that bill passed, and then they lost their daughter while on the waiting list. And there's many more that are dying every week."

Anna Conte, 9, who suffered from seizures, died due to complications from her disorder. New York lawmakers passed a medical marijuana bill last year, but it won't take effect for a

year and a half. Since its passage, two other children with seizure disorders similar to Conte's have also died.

According to Parents Coalition for Rescheduling Medical Cannabis, 3,000,000 Americans are afflicted with neurological disorders or seizures of which 1,000,000 could benefit from CBD Therapy.

The House bill must successfully pass multiple House committees before it reaches the floor for consideration.

The bill is among several recent moves in Congress to change longstanding federal marijuana policy. The House recently voted to block the Drug Enforcement Administration from targeting medical marijuana operations that are legal under state laws -- a vote that surprised even longtime supporters of marijuana policy reform. In May, House lawmakers also approved a measure that would prohibit the DEA from using funds to crack down on state-legal industrial hemp programs. In May, 219 members of the U.S. House voted for a bipartisan amendment that was sponsored by Republican Congressman Dana Rohrabacher, Democrat Congressman Sam Farr and ten other members of Congress prohibiting the DEA from undermining medical marijuana laws in twenty-three states, as well as eleven additional states that regulate CBD oils. Senator Rand Paul (R-KY) and Senator Cory Booker (D-NJ) introduced a similar amendment in the Senate but a vote by the Senate on the amendment was never held. The House amendment made it into the final appropriations bill, marking the first time Congress has ever cut off funding to marijuana enforcement. Another House amendment sponsored by Republican Congressman Thomas Massie and Democrat Congressman Earl Blumenauer prohibiting the DEA from undermining a federal law that allows industrial hemp research under certain circumstances also made it into the final appropriations bill.

The Department of Justice has issued 2 related memorandum of late - a Justice Department memo of November 2014 informs all United States Attorneys that their marijuana enforcement efforts on Native American tribal lands should be guided by a 2013 DOJ memorandum previously urging prosecutors not to interfere with state-sanctioned cannabis regulatory schemes, provided that such activities do not violate specific federal priorities such as marijuana sales to minors or the plant's diversion to states that have not legalized its use. The memorandum, by Director Monty Wilkinson states, "The eight priorities in the Cole memorandum will guide United States Attorneys' marijuana enforcement efforts in Indian Country, including in the event that sovereign Indian Nations seek to legalize the cultivation or use of marijuana in Indian Country."

The second memorandum, issued in 2014, is similar in scope and advises United States Attorneys' about enforcement efforts within States where hemp and Cannabis are legal.

The final version of the 2014 House omnibus appropriations bill includes the Rohrabacher-Farr amendment. The amendment restricts the Department of Justice and the Drug Enforcement Administration from using taxpayer funds to interfere in state-sanctioned medical marijuana programs in the 20+ states that have enacted them. The 2015 Spending Bill was signed into law by President Obama on December 17, 2014, with this amendment intact.

On January 28, 2015, during the U.S. Senate Judicial Committee confirmation hearing of Attorney General nominee Loretta Lynch and in response to questions posed by Senator Lindsay Graham (R-NC), Lynch confirmed that current federal laws stipulates that marijuana in any form, is a violation of federal law and, in her role of Attorney General,

should would enforce the law of the country. This despite States legalization approving of hemp, medical and recreational marijuana. Lynch welcomed, if confirmed, both the opportunity to work with the Senate Committee on this issue and report back to the Committee (assuming confirmation) after she discussed the issue with DEA Administrator Michele Leonart who on September 17, 2014, in front of the House Judicial Committee said the DEA supported additional research that "may lead to the development of new pharmaceuticals that may harness the therapeutic benefits of cannabinoids, while minimizing or eliminating the harmful side effects (including the 'high') produced by eating or smoking marijuana."

WHAT AMERICAN ACADEMY OF PEDIATRICS (AAP) SAYS

Marijuana use should be decriminalized and federal officials should reclassify cannabis as a less dangerous drug to spur vital medical research, the leading group of U.S. pediatricians recommended January 25, 2015.

In an update to its 2004 policy statement on pot, the American Academy of Pediatrics (AAP) also recognized marijuana may be a treatment option for kids "with life-limiting or severely debilitating conditions for whom current therapies are inadequate."

That new stance is welcome news to some 200 families with ill children who recently moved to Colorado — where marijuana is legal for adults — in searches for last-ditch cures. Those remedies include the pot strain called Charlotte's Web, which anecdotally has been shown to control seizures in some kids.

"We don't want to marginalize families who feel like this is the only option for their child because of crisis," said Dr. Sharon Levy, chair of AAP's committee on substance abuse and assistant professor of pediatrics at Harvard Medical School. She was one of the statement's co-authors.

Media accounts of medical-marijuana refugees in Colorado have given doctors "reason to suspect" that cannabinoids — the chemical compounds secreted by cannabis flowers — might have anticonvulsant properties, Levy said.

Charlotte's Web, for example, hemp which is selectively bred that contain low levels (0.03%) of the cannabinoid THC, which causes people to feel high, but elevated levels of cannabidiol, or CBD, which does not have psychoactive effects. In one medical trial, CBD was shown to be possibly effective in treating people with Parkinson's disease, though more study is needed, scientists have said.

"We understand why a desperate parent might say, 'Look it's going to take 10 years to do this research.' We think that kind of compassionate use should be limited to children who are truly debilitated or at the end of life," Levy said in an interview with NBC News. Asked to list those debilitating illnesses, Levy cited severe seizure disorders.

The AAP remains otherwise opposed to marijuana use among children and adolescents through the age of 21, and it continues to stand against the broader legalization of pot.

THE COMPETITION - Hemp Production North of the Border

Since wide spread production of Hemp was illegal in most of the United States up until recently which has all but eliminated data, it may be best to look to what Canada and, specifically the Province of Ontario, which shares many similarities with us – culturally, regulatory, demographics, soils, climate and topography – to see the potential for Pennsylvania.

Canada's windfall has been largely due to the American demand for omega-balanced hempseed oil. But hemp is also a go-to material for dozens of applications all over the world. In a Dutch factory they produce stronger-than-steel hemp fiber that's used in Mercedes door panels, and Britain's Marks and Spencer department store chain used hemp fiber insulation in a new flagship outlet. "Hempcrete" outperforms fiberglass insulation.

Yet Hemp was banned in Canada until 1998 when Canada created Industrial Hemp Regulations under the Controlled Drugs and Substances Act. These regulations allow for the controlled production, sale, movement, processing, exporting and importing of industrial hemp and hemp products that conform to conditions imposed by the Regulations.

Under the Regulations, industrial hemp seeds must be of a variety listed in Health Canada's List of Approved Cultivars. Plants and plant parts may not contain more than 0.3% THC when sampled and tested in the approved manner. Products made or derived from hemp must not contain more than 10 micrograms of THC per gram. Industrial hemp stalks, with leaves and flowers removed, and non-viable hemp seeds (grain), are exempt from the Act. Anyone found in possession of hemp plant parts - other than the stalk and non-viable grain, without the appropriate license - is in possession of a controlled substance and may be charged under the Act.

Industrial hemp may only be grown under license from Health Canada. Leaf or seed residue found in vehicles or machinery, without the proper licenses, may constitute possession of a controlled substance in Canada or elsewhere. Thorough cleaning of vehicles and equipment is required under the Industrial Hemp Regulations.

Industrial hemp licenses are issued for a calendar year only and must be renewed if product is carried into the new year. Hemp licenses are only valid in Canada. Transporting product in any form to another country, including the United States, may constitute an offence in that country.

Licenses to grow industrial hemp are issued for crops of 4 ha (10 acres) or more. Seed breeding and small-scale experimental activities may be carried out using Breeder or Research permits only. Applicants for any commercial hemp license must submit a current police criminal record check with their license application.

Because industrial hemp is a controlled substance, every aspect of its handling, production and marketing is controlled by licenses issued to the operator.

Growers of industrial hemp must give the Office of Controlled Substances the exact Global Positioning System (GPS) co-ordinates of each proposed industrial hemp plantation. Volunteer plants or other hemp plants found outside these co-ordinates contravene the Industrial Hemp Regulations and fall under the Criminal Code. These plants may be destroyed by cutting, pulling, cultivation or by herbicides. Refer to Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) Publication 75, Guide to Weed Control for recommendations. The grower must also arrange for tissue sampling of the crop by a

certified sampler and laboratory THC analysis. The cost of these operations is borne by the grower.

Development of the Canadian Industry

Historically, industrial hemp is known for its bast Fiber used to make strong fabrics and ropes. Earlier technology was very labor-intensive, and is not suitable in today's high-speed industrial environment with high labor costs. Canadian and European entrepreneurs are developing new technology for woven Fiber textiles, but it is not in general use at this time. Non-woven materials such as felts, carpet padding and plastic reinforcing are creating some markets for hemp Fibers. Core Fibers are being used for horse and pet bedding, but are adaptable to a wide variety of other products.

Hemp grain is a source of food oil and meal and has many applications for human and animal food products. Hemp oil contains a unique mixture of omega 6 and omega 3 fatty acids, as well as gamma linolenic acid (GLA), an acid involved in the synthesis of prostaglandins in the body. The oil is being used in cosmetic creams and food products. The main drawbacks at the present time are hemp's relatively low yield of grain, oil extraction technology and stability of the oil.

In spite of these constraints, oil may be the first industrial hemp product to be commercialized successfully. One industrial hemp seed company in Ontario has a breeding program aimed at creating varieties with specific oil and Fiber characteristics.

Hemp oil meal and the de-hulled hemp grain, known as hemp nut, are used to make such food products such as granola bars and cookies. Because they are new products with unique flavors, it may take some time for these products to gain general acceptance by consumers.

Whole hemp grains must be sterilized if they are to be used as birdseed, sold as roasted seeds for human consumption or for any other use or for export. Unsterilized grains may be used for processing within Canada.

Markets for hemp fibers and seed products are being developed, but may not be close to the desired growing location. Transportation of raw materials is a significant cost factor in the manufacture of goods. Growers should make sure they have secure contracts before planting industrial hemp as a cash crop in Ontario.

Description

Industrial hemp is made up of varieties of Cannabis sativa that contain less than 0.3% THC as described earlier. It is an annual broadleaf plant with a taproot and is capable of very rapid growth under ideal growing conditions. The female flowers and seed set are indeterminate, meaning that the seeds continue to develop and mature over an extended period of time. This means there are both ripe and immature seeds on the same plants at time of grain harvest.

When grown as a fiber crop, hemp may grow to a height of 2-4 m without branching. In dense plantings, the bottom leaves atrophy due to the exclusion of sunlight. Male plants die back after shedding pollen.

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. These give the quality and

strength for which hemp is renowned. The core contains the hurds, or short fibers, similar to hard wood fibers, that are useful in other applications like particleboard or horse bedding.

For grain production, the plants may branch and reach heights of only 2-3 m. tall plants do not necessarily produce more grain than short ones. Shorter plants are preferred for combining.

In well-structured and well-drained soils, the taproot may penetrate 15-30 cm deep. In compacted soils, the taproot remains short and the plant produces more lateral fibrous roots.

Figure 3: Cross-section of hemp stems.

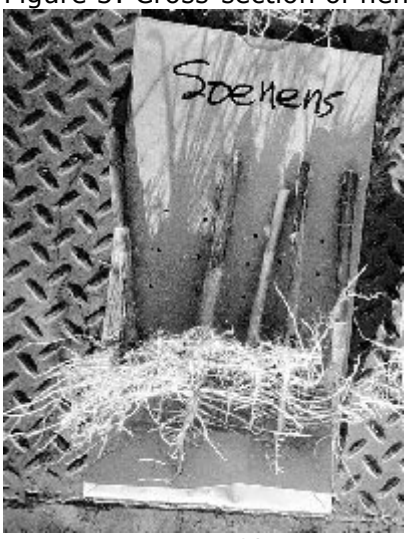


Figure 4: Roots of hemp.

Varieties

Industrial hemp varieties tested in Ontario to date have all been of European origin, with the exception of new Ontario-bred varieties such as Anka and Carmen. They come in 2 types: Dioecious, which have male and female flower parts on separate plants (e.g., Kompolti and Unico B), and Monoecious, which have male and female flower parts on the same plant (e.g., Ferimon and Futura). A third type of cultivar, known as Female Predominant, is a dioecious type that has 85%-90% female plants. It is believed this type can produce a higher yield of grain. Most French varieties are hybrid populations of predominantly female types.

Each industrial hemp variety has its own set of characteristics: small or large seed; higher or lower oil content; different oil composition, etc. Varieties grown for fiber may contain from 15%-25% of bast fibers. As markets develop, contracts to grow industrial hemp may specify the exact varieties that will be grown to meet specific market needs.
Only varieties of industrial hemp 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% THC under normal conditions. The THC level may vary with stage of growth and increase under environmental stress conditions. They mature to fiber in 60-90 days and to grain in 110-150 days.

Dual Purpose Cultivars

Most of the French and Romanian cultivars are suitable for both grain and fiber production. These tall cultivars present some challenges for harvesting. Growers need also to consider that weather conditions after grain harvest (late August or September) may not be suitable for retting and drying of the stalks. The FIN 314 variety, which will grow to a maximum height of 0.9 m (36 in.), and other short stalked grain types (1-1.5 m) are not suitable for dual production. Industry trends seem to be moving toward specific grain or fiber varieties.

Soil Conditions

Hemp responds to a well drained, loam soil with a pH (acidity) above 6.0. Neutral to slightly alkaline (pH 7.0 - 7.5) is preferred. The higher the clay contents of the soil, the lower the yield of fiber or grain produced. Clay soils are easily compacted and hemp 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 (about 30 cm. 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 plant. Accordingly extra nutrients and water are required to achieve maximum yields on these soils. The cost of irrigation on sandy soils may make production uneconomical.

Seedbed Preparation and Planting

For optimum germination, industrial hemp seed requires good seed-to-soil contact. The seedbed should be firm, level and relatively fine; similar to that prepared for direct-seeded forages. The soil can be worked and planted as soon as the ground is dry enough to avoid compaction. A shallow, firm seedbed allows seed to be placed at a uniform depth, resulting in a more even seedling emergence. Industrial hemp is normally sown using a standard grain drill. Plant seed at a depth of 2-3 cm. Optimum soil temperature at that depth for fast germination is 8-10oC, although hemp seed will germinate at 4-6oC.

Industrial hemp that is planted for fiber is usually sown in 15-18 cm (6-7-in.) rows, using every run of the drill. Optimum final stand is about 200-250 plants/m2. Early seeding (as soon as soil conditions are appropriate) is recommended. Researchers recommend a minimum seeding rate of 250 seeds per m2. Planting rate is recommended at 45 kg/ha. This could be higher if germination is low and seed is large. Table 2 shows how the seeding rate changes according to seed size and density (weight per 1000 seeds) for most varieties. Seed density is specific to each variety, and is more or less constant from year to year. Seed density information should be available from the seed supplier.

Industrial hemp is day-length sensitive, resulting in greater vegetative growth if planted earlier. As days become shorter, 4-5 weeks after the summer solstice (June 21) vegetative growth slows and flower development is triggered. Early planting takes advantage of this feature, resulting in taller plants with higher fiber yields. This does not change the cutting date significantly.

For grain production, desired final plant population is around 100-150 plants/m2. Like fiber hemp, seeds are still planted in 15-18 cm (6-7 in.) rows. Soil temperature determines the optimum planting date.

Climatic Conditions

Hemp requires a lot of moisture. The crop needs 300-400 mm (10-13 in.) of rainfall equivalent. Since that amount of rainfall seldom occurs during the growing season, it is important to make use of early soil moisture and to obtain early ground cover to reduce surface evaporation, as well as to maintain good weed control.

About half of this moisture is required during flowering and seed set in order to produce maximum grain yields. Drought during this stage reduces seed set and produces poorly developed grain heads. Continued drought results in low yields of light grain.

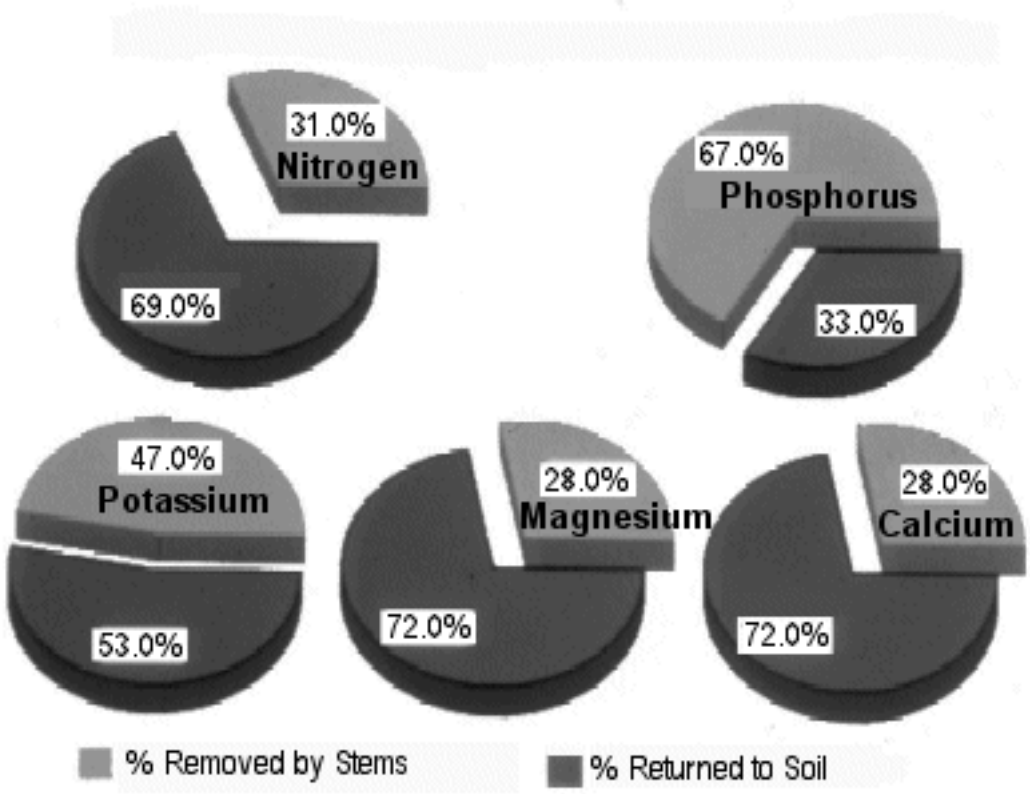
During the period of vegetative growth, hemp responds to daytime high temperatures of 25°C-28°C. Young volunteer plants grow slowly at temperatures as low as 2°C., both in Northern and southern Ontario. After the third pair of leaves develops, hemp can survive daily low temperatures as low as -0.5°C. for 4-5 days.

Fertility

Hemp requires approximately the same fertility as a high-yielding crop of wheat. Research is continuing to define the exact nutrient requirements. Apply up to 110 kg/ha of nitrogen, depending on soil fertility and past cropping history. Research to date supports the application of 40-90 kg/ha of potash for fiber 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.

It is important to balance the nutrients applied with the crop requirements and with each other. Excessive nitrogen, combined with inadequate potash, for example, can result in stalk breakage and loss of the crop.

About 42% of the plants' biomass returns to the soil in the form of leaves, roots and tops. These contain over half of the nutrients applied to the crop. Many of these nutrients will be available to help feed the following crop.



Hemp Plant Nutrient Uptake and Return.

Weed Control

If hemp is planted in well-drained, fertile soil under nearly optimum temperature and moisture conditions, it will germinate quickly and reach 30 cm 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. It appears that rapidly growing hemp, at a final population of 200-250 plants/m2, will suppress nearly all weed growth, including twitch grass.
Weed suppression is not a permanent condition. Weeds may appear on the same field next year if the field is rotated out of hemp production. Perennial grasses may be weakened or killed if hemp is grown a second year on the same ground. However, this practice increases the opportunity for 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, aiding the germination of weed seeds. Research indicates that plant populations as low as 50-100 plants/m2 may give adequate, though not 100%, weed control. Cross seeding may improve canopy distribution and subsequent weed control where very early, shorter varieties are grown.

No herbicides have been approved for industrial hemp. Early planting, as soon as the soil is warm enough, is a recommended weed control strategy.

Diseases and Pests

More than 50 different viruses, bacteria, fungi and insect pests are known to affect the

hemp crop. However, hemp's rapid growth rate and vigorous nature allow it to overcome the attack of most diseases and pests.

As the acreage of industrial hemp and alternative disease hosts increases in a given area, the population of disease or pest organisms will tend to increase. The following pests have been noted in hemp fields in Ontario. Botrytis cinerea (grey mold) and Sclerotinia sclerotiorum (white mold) are common molds affecting industrial hemp. Sclerotinia also affects edible beans, canola and sunflowers. It has been found on more than 10% of plants where industrial hemp followed canola. Sclerotinia spores (sclerotia) may be spread by combines, other harvesting equipment and straw. Fusarium, the pink mold found on corn and wheat, has been seen on the roots of hemp plants. The effect that an additional host crop will have on the viability of these crops may not be known until industrial hemp is grown more intensively in bean and canola-growing areas.

European Corn Borer has affected some stands and grasshoppers have done some damage to hemp crops. Bertha Army Worm (Mamestra configurata) has been a pest in Manitoba and could find its way to industrial hemp crops in northwestern Ontario.

Other diseases and pests have been identified, with varying degrees of severity, in other provinces.

No pesticides or fungicides are registered for use on hemp in Ontario. Crop rotation would appear to be a good cultural practice to avoid disease build-up until more is known about hemp's susceptibility to disease organisms. A 4-year rotation is recommended. Do not grow hemp on the same fields following canola, edible beans, soybeans or sunflowers. Wind and hail damage can be significant to the industrial hemp 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. Small plants damaged by hail recovered quickly and developed quite normally if they were not severed below the first node. Weather stresses may result in higher THC levels in the remaining crop.

Bird damage has been severe in some areas of Ontario and Manitoba. Significant losses in grain yields up to the entire crop have been reported.

Harvesting Fiber Hemp

Air-dry stem yields in Ontario have ranged from 2.6-14.0 tonnes of dry, retted stalks per hectare (1-5.5 t/ac) at 12% moisture. Yields in Kent County have averaged 8.75 t/ha (3.5 t/ac). Northern Ontario crops averaged 6.1 t/ha (2.5 t/ac) in 1998. Researchers feel earlier planting, optimum production management and more suitably adapted varieties can result in higher yields.

Approximately one tonne of bast fiber and 2-3 tonnes of core material can be decorticated from 3-4 tonnes of good quality, dry retted straw.

Yield of fiber depends on both the stalk yield per hectare and the fiber content of the stalk. Varieties differ in the amount of actual fiber they contain, and on the ratio of bast fiber to core materials (hurds). Dioecious varieties originating in southern Europe give the highest stalk yields. Further processing may be required to attain the quality of fiber needed for some end uses.

For textile applications, cut hemp in the early flowering stage or while pollen is being shed, but before seed sets. Fiber that is cut after seed harvest will have lignified considerably and is usable only in some non-woven industrial fiber applications. In dioecious varieties, the male plants die back after shedding pollen. This results in lower fiber 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 hemp. 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 and Turning

Retting is the process of beginning to separate the bast fibers from the hurds or other plant tissues. It is done in the field, taking advantage of the natural elements of dew, rain and sun, or under controlled conditions using water, enzymes or chemicals. The method chosen depends on the end use to which the fiber will be put. Suitable industrial processes for water and chemical retting have not been developed.

Successful field retting requires a delicate balance of nightly dews and good daytime drying conditions. The southern Ontario climate may dictate that field retting be done no earlier than the end of July in order to assure adequate dew conditions. Planting date and selection of variety are factors in predicting a suitable harvest date.

The length of the retting process is critical for optimum fiber yield and quality. It normally takes 21-28 days to complete, but dry August weather with low dew conditions may necessitate longer retting periods. Occasionally, the process may take as little as 14 days. The windrows are turned vigorously once or twice with a tedder or rake 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 fibers reach the desired color, and do not rot or discolor in storage. In wet conditions, a third turning may be necessary. Excessive leaves left on the stems will hinder drying and may cause the straw to contravene the regulations under the Controlled Drugs & Substances Act.

Baling and Storing

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

Bales must be stored indoors under dry conditions to stop the retting process before the fibers become rotted. Stalk moisture should be less than 15% at time of baling, and should continue to dry to about 10%. No observations have been made to date on bales stored under plastic, but experience with hay storage indicates that moisture would be wicked up from the ground and some spoilage would take place unless the bales are separated from the bare ground. This often occurs even on deep gravel floors indoors. Hemp straw also absorbs air moisture quite readily.

Grain Harvesting Followed by Fiber Harvesting

When industrial hemp is grown for both grain and fiber, 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 fiber 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. Fall weather conditions in Northern Ontario would not normally be suitable because of poor drying conditions. The fiber from the mature stalks after grain harvest will be lower in quality and high in lignin. Such fiber would be suitable for manufacturing into composites, non-woven mats, particleboard, and possibly for pulping.

Combining Grain Hemp

Combining hemp provides a special challenge to both the combine and the operator. In tall varieties, large quantities of plant material are put through the combine. Hemp straw contains very tough fibers that tend to wind around moving parts. Fine fibers 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 such as Fedora 19, FIN314 and Fasamo are shorter and easier to combine.

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

Raising the cutting blade to about 1 metre (40 in.), 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 minimize winding of fibers on the sickle bar. Replacing the slatted feeder conveyor with a belt helps reduce the amount of fiber 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, and air and cylinder speeds. The following settings are suggested for conventional combines: cylinder speed at 250 rpm, fan speed at 1070 rpm, 1/8-inch sieve and 3/8-inch chaffer, concave set tight. Run feeder-housing chain loose in the corn position and close the pre-cleaner. Lower the beater grate, 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 a tendency to plug more readily.
Reported grain yields in Ontario have ranged from 300 to 1300 kg/ha at 12% moisture, after harvesting and cleaning. Higher yields may be possible as varieties and production technology improve.

Some "volunteer" hemp will likely appear in the fall or spring following the hemp crop. Thorough cultivation or seedbed preparation is effective.

Economics of Production

Costs of production vary with individual circumstances. Small acreage. Low yields, age and cost of equipment used, cost of land and alternative uses for the land all contribute to the cost of producing a tonne of hemp straw or grain.

The value of the straw varies according to its demand in the market place. Factors such as fiber length, fineness, color and the demand for a specific quality of fiber affects the farm-gate price. These qualities are influenced by the variety of industrial hemp, the maturity of the plants, conditions during retting and quality of storage. Yield of straw affects both costs and returns per hectare.

The price of hemp straw varies according to the individual market place. Contracts have been offered to growers, but it is not known if the price offered was representative of the true market value. There are no reliable price or quality indicators in Ontario at the present time. Actual prices paid to the grower have ranged from $70-$180 per tonne, depending on quality and intended use. Persons considering industrial hemp as a cash crop are advised to secure a contract with a reliable firm before investing in the crop.

Grain markets have been slightly more active, and prices have been noted between $0.45-$0.55 per pound while markets were being expanded unhindered. Interference by U.S. customs with sales to U.S. markets in 1999-2000, and the loss of a major contractor in Western Canada in the same period has created much uncertainty in the hemp grain marketplace.

The Future of Hemp in Pennsylvania and the U.S.

As we transition to a future that embraces more sustainable agriculture practices industrial hemp can help lead the way. With focused and sustained research and development, hemp could spur dramatic positive ecological and economic benefits.

Hemp is not a panacea for our social, economic, and environmental woes—no single crop can do that. Yet it deserves the opportunity to become a mainstay crop, that is researched and developed, grown to its potential and that is free of the threat of prosecution and imprisonment.

Pennsylvania can lead this resurgence.

Yet in order for the industry to be successful in Pennsylvania and throughout the country, as part of any legislation reintroducing the crop, their must be a complimentary marketing initiative, educating each of us on the uses and benefits of industrial hemp and promoting ways we can help grow the hemp marketplace.

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