Wisconsin State Senate
24th Senate District

Serving Wood, Portage, Adams,
Waushara, Monroe, and Jackson

PATRICK TESTIN
STATE SENATOR

DATE: October 10, 2017
RE: **Testimony on 2017 Senate Bill 119**
TO: The Assembly Committee on Agriculture, Small Business, and Tourism
FROM: Senator Patrick Testin

Mr. Chairman and Committee Members, thank you for allowing me to testify on behalf of Senate Bill 119, which would allow the growth, cultivation, and marketing of industrial hemp here in Wisconsin. If Wisconsin is given the ability to grow hemp, we can lessen our dependency on imports of yet another commodity.

Prior to its ban several decades ago, Wisconsin was a leading producer of hemp across the country, with nearly three-quarters of American hemp being grown in our state. Hemp grows well in Wisconsin, as it is a sturdy plant that can withstand Wisconsin's environment, and does not consume large quantities of water. Unfortunately, for nearly 60 years, farmers here have been prohibited from growing this safe, useful, and non-psychoactive crop because of its relation to marijuana.

Interestingly, you will still find hemp in many day to day products. When cultivating hemp, the crop's high fiber stalks can be used to make clothing, building materials, and fuel. Additionally, the seeds can be used to make food, produce Omega 3 oil, strengthen plastics, and create flame retardant protection for firefighters.

Although it is a close cousin of marijuana, industrial hemp, or Cannabis sativa L, is a distinctly different genus from marijuana. However, due to its relation to marijuana, it has been mislabeled as a narcotic. Simply put, hemp is not marijuana and hemp does not offer the hallucinogenic high that is found in marijuana. In fact, our legislation states that should hemp contain even 1% of THC, the psychoactive drug found in marijuana, it must be destroyed by the proper authorities.

By allowing hemp to be safely grown on the farm down the road instead of the farm in a different state or country, Wisconsin businesses can capitalize on the reintroduction of hemp by offering new products to consumers across the country. While Wisconsin farmers sit on the sidelines, many states have begun to allow farmers to diversify their crop production with industrial hemp.

PO Box 7882 • Madison WI 53707-7882 •608-266-3123 • 800-925-7491 • Sen.Testin@legis.wi.gov • www.SenatorTestin.com

Due to the 2014 Farm Bill signed by President Obama, states have been given the ability to explore the use of industrial hemp. The Farm Bill included language that allows universities and state departments of agriculture to begin cultivating industrial hemp for limited purposes. 31 states have begun removing barriers from hemp production, including our neighboring states of Illinois, Indiana, Michigan, and Minnesota.

I understand that Senate Bill 119 is just a starting point. Representative Kremer and I would like nothing more than to safely reintroduce this important crop back into our state. We are open to ideas to make our legislation friendlier to the law enforcement, agricultural, and business communities. As the saying goes, there is more than one way to bake a cake; I believe this is certainly true with this bill.

As authors of SB 119, Representative Kremer and I have invited various advocates of industrial hemp, including a farmer from Kentucky and a Professor of Botany at the University of Indiana to better understand what hemp is and how it benefits our state.

Thank you for hearing SB 119 today. We ask that you support the growth, cultivation, and marketing of hemp moving forward. Wisconsin has led the nation in hemp production in the past and it is time for us to lead again.

JESSE KREMER

STATE REPRESENTATIVE • 59TH ASSEMBLY DISTRICT

Testimony before the Senate Committee on Agriculture, Small Business and Tourism
State Representative Jesse Kremer
October 10, 2017

Good morning,

Thank you Chairman Moulton and committee members for holding a public hearing on the "Farm Freedom Act". I appreciate the opportunity to testify on Senate Bill 119, legislation that will benefit the agriculture sector and create new high tech, and likely rural, manufacturing opportunities for Wisconsin.

Although our state is referred to as America's Dairyland, our agricultural diversity is an incredible economic driver. With roughly 68,700 farms and 413,500 jobs, Wisconsin's agricultural sector contributes a significant $88 billion to our overall economy each year. Wisconsin is the leading producer of cranberries, ginseng, snap peas, and until the 1970s, industrial hemp.

The Historical Context

Industrial hemp, although a close cousin of, and commonly lumped in with discussions on marijuana, is a distinctly different plant and genus – cannabis sativa. Industrial hemp is extremely low in THC to the extent that it has no psychotropic effects, but thousands of potential benefits. Industrial hemp is a dry crop that requires little water and can grow in harsher climates.

Industrial hemp is a commodity that has a rich history in Wisconsin. In the past, industrial hemp fiber was used for rope, parachute webbing, shoes and clothing; in fact, Wisconsin took the lead in supplying the War Department with industrial hemp during the early 20th century. In addition to growing and processing hemp for the military, Wisconsin manufacturers designed and manufactured industrial hemp farm machinery, an ingenious move that allowed Wisconsin production to remain heads and shoulders above the production of neighboring states.

Although industrial hemp was a large part of our agricultural sector, it was labeled a narcotic in 1970 when it became associated with a very different plant that bears a similar resemblance – marijuana.

The Current Landscape

Recently, a Republican Congress recognized the differences between industrial hemp and marijuana. The 2014 Farm Bill, signed by President Obama, prevented the Drug Enforcement Administration (DEA) from seizing and destroying industrial hemp in states that allow pilot research and growing programs for this crop. *The definition of industrial hemp as recognized by the federal government and referenced in SB 119 is one that contains no more than 0.3% THC by dry weight; and I will re-iterate again, that it is non-psychoactive.* Thirty one states have now defined industrial hemp as distinct and removed barriers to its production: Alabama, California, Colorado,

Capitol Office: Post Office Box 8952 • Madison, WI 53708-8952 • (608) 266-9175 • Toll-Free: (888) 534-0059 • Fax: (608) 282-3659
Rep.Kremer@legis.wi.gov • www.RepKremer.com

JESSE KREMER
STATE REPRESENTATIVE • 59TH ASSEMBLY DISTRICT

Connecticut, Delaware, Florida, Hawaii, **Illinois**, **Indiana**, **Kentucky**, Maine, Maryland, **Michigan**, **Minnesota**, Montana, Nebraska, Nevada, New Hampshire, New York, North Carolina, North Dakota, Oregon, Pennsylvania, Rhode Island, South Carolina, Tennessee, Utah, Vermont, Washington, West Virginia and Virginia. It should be noted that our neighboring states, and Kentucky in particular, have been leading the charge in this effort.

Currently, United States manufacturers import over half a billion dollars of industrial hemp annually. Re-introducing this crop to Wisconsin has the potential to expand our agricultural sector, give farmers hit hard by the recent Grassland milk crisis additional hope and options, create new manufacturing and tech opportunities, and ultimately produce new jobs and tax revenue. Industrial hemp fibers are stronger than carbon fiber and have already been used in protective fire gear, plastic panels in vehicles, brake pads, building insulation, super capacitors to replace graphene in high end batteries and to replace Kevlar in bulletproof vests.

From the human consumption and health aspect, the non-psychoactive CBD seed oils contain more Omega 3 than fish oils and can alleviate many more maladies than simple THC. CBD oil from industrial hemp, or the seeds themselves, are popular in shampoos, cosmetics, nutritional supplements, foods and beverages. It's very likely that many Wisconsinites have already consumed or used a hemp product or product that contains hemp.

Just this past December, Wisconsin's own Farm Bureau, a strong supporter of this bill, passed a policy urging the re-emergence of this commodity. Their official position states, "We support the production, processing, commercialization and utilization of industrial hemp and that it be regulated by USDA rather than the Drug Enforcement Agency (DEA)."

In addition, this bill has been reviewed and positively received by other stakeholders including the Wisconsin Department of Justice (DOJ), Department of Agriculture, Trade, and Consumer Protections (DATCP), and the UW-College of Agriculture and Life Sciences (UW-CALS).

Senate Bill 119 provides the opportunity for Wisconsin farmers and manufactures to grow and process a crop that we already import. We can continue to bring jobs to our state and become a leader in yet another industry nationwide. On behalf of the 40 co-authors, co-sponsors, and myself, I thank you for this opportunity and urge your support for the creation of an industrial hemp pilot program under the "Farm Freedom Act".

Capitol Office: Post Office Box 8952 • Madison, WI 53708-8952 • (608) 266-9175 • Toll-Free: (888) 534-0059 • Fax: (608) 282-3659
Rep.Kremer@legis.wi.gov • www.RepKremer.com

DAVE CONSIDINE
STATE REPRESENTATIVE
81st ASSEMBLY DISTRICT

STATE CAPITOL PO Box 8952, Madison, WI 53708
PHONE (608) 266-7746 **TOLL-FREE** (888) 534-0081
EMAIL Rep.Considine@legis.wisconsin.gov
WEB http://legis.wisconsin.gov/assembly/81/considine

October 10, 2017

Good afternoon, Chairman Moulton and committee members. I want to start my testimony by thanking you for holding this hearing. I'd also like to thank Representative Kremer and Senator Testin for introducing this bill. I've been working on this issue since 2015, and I really appreciate the opportunity to have a productive conversation on industrial hemp together.

Hemp presents a major opportunity not just for our agricultural economy, but for Wisconsin tourism as well. I was recently in Kentucky and picked up a brochure detailing an historic "hemp trail," where participants could visit notable locations and learn about the history of hemp in Kentucky. Why not do something similar in Wisconsin? We could do that and more if we allow our farmers to grow industrial hemp. I hope we take this chance to move forward into an industry that could be highly beneficial to our state.

I am here because I agree that we need to pass a hemp bill this session, but I think we all want it to be a *good* hemp bill. The bill before you today is not a bad bill, by any means, and I'm not here to speak against it. I simply believe it could be better, and I want to offer my suggestions.

I have introduced three amendments to the Assembly version of this bill, and I respectfully recommend that the Senate do the same:

- Remove the criminal background check requirement in the licensing process
- Remove the provision to seize and destroy crops that test over 0.3% THC
- Remove the provision requiring tribes and tribal members to obtain a license through DATCP

I believe these provisions are unnecessary and will cost the state extra money and resources without any additional benefit. I'm also concerned that these parts of the bill will end up *discouraging* farmers to experiment with growing hemp, which is not our goal. These sections may also unintentionally reinforce the mistaken connection many people see between hemp and marijuana. If we are going to effectively advocate for industrial hemp to become a reality in Wisconsin, we all know we need to fight the assumption that marijuana and hemp are the same. Amending the bill as I have proposed would help us do that, while preserving farmers' ability to invest in this new crop and explore its benefits for themselves. I have no doubt that when they do, many more people will see industrial hemp the way we do: as a significant economic opportunity for our state.

Thank you again for your time and attention. I'm happy to answer any questions you may have.

KATHLEEN VINEHOUT
STATE SENATOR

Testimony in Support of SB 119- Legalization of Hemp
Senate Committee on Agriculture, Small Business and Tourism
Tuesday, October 10, 2017

I thank Chairperson Moulton and committee members for your consideration of Senate Bill 119, which allows the Department of Agriculture and Consumer Protection (DATCP) to create an active industrial hemp program and license growers.

Farmers in diverse states like Hawaii, Kentucky, Maine and Minnesota are researching a new crop: industrial hemp. Many states are changing laws to allow growing of hemp.

Wisconsin is slow to get in the game. Hopefully, this is about to change. I am pleased SB 119 is moving forward and receiving a public hearing, today.

Hemp is not a new crop to Wisconsin. We once had flourishing fields of hemp. But, as the saying goes, you are sometimes known by your relatives. Even for a plant. Hemp suffered from an association with its cousin, marijuana. By the 1950s, farmers stopped growing hemp. Federal and state drug laws swept up hemp in an effort to eradicate marijuana.

According to a Congressional Research Service (CRS) publication, industrial hemp and marijuana are separate varieties or cultivars of the same species of plant *cannabis sativa.*

Generally, hemp is defined by having less than 0.3% of THC, an active ingredient in marijuana. However, the plant differs in other genetic aspects, in cultivation practices, and in its use.

Thirty countries around the world grow hemp as an agricultural commodity. Hemp can be used to create plastics, mixed with lime to create concrete, as a fiberglass alternative for use by aviation or automobiles or as a potential biodiesel fuel. The CRS reports more than 25,000 hemp products fall into nine markets: agriculture, textiles, recycling, automotive, furniture, food and beverages, paper, construction materials and personal care.

According to the CRS, growth in the sale of hemp products averaged over 15% annually between 2010 and 2015. The biggest demand for hemp related products are hemp-based body products, food or supplements. These products account for more than 60% of the value of U.S. sales.

Until recently, U.S. farmers were forbidden to grow hemp. This policy forced industries to import hemp raw materials or use finished hemp products for further processing. China now leads the world as a grower and supplier of hemp. United States processors also rely heavily on Canadian growers.

State Capitol • P.O. Box 7882 • Madison, WI 53707-7882 • Office: (608) 266-8546 • Fax: (608) 267-2871
Toll Free: (877) 763-6636 • Sen.Vinehout@legis.wisconsin.gov

A provision in the 2014 federal Farm Bill allowed universities and state agriculture departments to begin supervising hemp in pilot programs. This caused a flurry of activity within state legislatures to create new hemp laws.

According to the National Conference of State Legislatures (NCSL) as of July 2017, 33 states passed some legislation related to industrial hemp including all our Midwestern neighboring states except Iowa. Twenty-six states created laws that began research on hemp, or a grower pilot-program.

Many states passed laws encouraging the development of hemp for certain purposes. For example, Colorado is researching the use of hemp for animal feed. Kentucky funded research on the use of hemp for biofuels. North Carolina is studying hemp for soil conservation and reforestation. The CRS cites research showing hemp may be less environmentally degrading than some other crops. Hemp can play a role in crop rotation, breaking the cycle of disease and pests.

Wisconsin farmers are eager once again to get in on hemp production. The Wisconsin Farm Bureau and the Wisconsin Farmers Union are advocating for the passage of SB 119. Farmers from both organizations and local agriculture agents contacted me asking for quick passage of the SB 119.

Like many agricultural issues, hemp legislation this year has strong bipartisan support. I along with forty other cosponsors of both parties signed up to help pass SB 119. For many years, I worked on this issue with a variety of stake holders—even introducing a similar piece of legislation last session.

In addition to creating an industrial hemp program and license, the bill before this committee adds some important provisions. SB 119 gives the UW a role in supervising a seed certification program. The bill allows any university or tribe to establish agricultural hemp plots. Additionally, it encourages our State Tribal Relations Committee to investigate hemp as an economic development tool for our tribes.

Hemp in Wisconsin is a crop whose time has come. Passage of SB 119 will begin the work of bringing back Wisconsin's hemp industry. Let's make 2017 the year of hemp.

Tuesday, October 10, 2017

Katie Moyer Testimony

From advocate to processor

When I began my journey into hemp, I never dreamed that in a few short years I would be one of Kentucky's leading voices and advisors on the crop. I began my journey with a simple bit of information — Hemp is 7 times more efficient for making ethanol than corn. Living in Christian County, KY, the largest agricultural county in Kentucky, and home to a massive ethanol co-op, this bit of information quickly caught my attention.

I started advocating for hemp, traveling the state and speaking with anyone who cared to listen. I also drafted a bill to create a framework for hemp production in Kentucky, and enlisted my State Senator to sponsor the legislation. This gave us a starting point, and a specific goal which we could pursue. One of the people I had a chance to educate about the bill was Congressman James Comer, who, at the time, was a State Representative. At the time he was running for Commissioner of Agriculture, and promised that if he were elected, the first thing he would do is become the state's leading advocate for hemp. He delivered on that promise, and not long after he was elected, he reorganized the Kentucky Industrial Hemp Commission, and recommended me as one of the House-Appointed members of the commission.

On the KIHC I had the opportunity to meet with State Legislators, Sheriffs, Judge Executives, Magistrates, Mayors and more. I met with farmers, teachers, students and Kentuckians from all walks of life. This was a far cary from what I was able to accomplish on my own. When we passed the bill — with flying colors — I was tasked with working with Department of Agriculture lawyers to draft regulations that would oversee actual production of hemp in Kentucky.

In 2014, the U.S. Senate added a provision to the FARM Bill that would allow state Departments of Agriculture and Universities to grow hemp for research purposes. In Kentucky, our Department of Ag contracted with private farmers to produce, process, manufacture, and market hemp. I was one of those first producers, and with the help

of Wisconsin native Ken Anderson, I was the first to bring certified hemp seed into Kentucky for planting.

In 2014, we planted a combined total of one acre of hemp, divided between two fields in the Northern and Southern ends of the county. In 2015, again with the help of Ken Anderson, we grew 100 acres of hemp for grain. In 2016 we produced another 100 acres of hemp for both grain and CBD, and this year we produced 130 acres of hemp for both grain and CBD.

As one of Kentucky's leading advocates, producers and advisors for hemp, I have been privy to all of the inner workings of our regulatory system, our laws, and any roadblocks or obstacles that we've had to overcome. I've seen the good and the bad, from the viewpoint of both private sector producer and public regulator — and although we have made mistakes, we have also learned some valuable lessons about cannabis, the plant, the regulations, the uses and benefits. I've seen hemp change lives; whether it was the stay at home mom in Madisonville who started a business making handmade hemp oil soap and lotion to help make ends meet, or the CBD customers who have given up their opiates in favor of a more natural alternative. I'm excited an honored to have this opportunity to share some of my own experiences and education about a crop that can truly change the course of history, in Kentucky, Wisconsin, and the rest of the nation.

HEMP REINTRODUCTION INTO WISCONSIN AGRICULTURE AND INDUSTRY

by Prof. Emer. Paul G. Mahlberg

A. TOPICS.

1. **Distinguishing between industrial hemp and marijuana.**
2. **Hemp varieties.**
3. **Administration of hemp program.**
4. **Plant growth pattern.**
5. **Pollination of hemp and marijuana.**
6. **Cannabis secretory glands.**
7. **Glandular THC and plant sampling for THC analyses.**
8. **Industrial applications of hemp.**
9. **Cannabis publications of Paul G. Mahlberg.**

B. ABOUT THE AUTHOR.

Prof. Emer. Paul G. Mahlberg (B.S./M.S., U.W., Madison; Ph. D., Berkeley, 1958).
Department of Biology, Indiana University, Bloomington, IN.

MY BACKGROUND ON CANNABIS.

Studied Cannabis for over 30 years (retired from my laboratory in 2003).
Had a DEA Schedule I research license to possess and grow Cannabis,
Collected over 100 Cannabis varieties worldwide for this research.
Grew and studied all varieties in greenhouses on the university campus.
Identified and localized cannabinoids to be present/produced in glands.
Published 39 research articles on Cannabis.
Served as consultant on Cannabis to the School of Pharmacy, Univ. Miss.
Served as consultant to United Nations, Narcotics Division, Vienna.
Visited with Prof. Ivan Bocsa, hemp breeder, at his laboratory in Hungary.
Member of Board of Director, North American Industrial Hemp Council.
Member of Hemp Industries Association.

C. TOPICS CONTENT.

1. Distinguishing between industrial hemp and marijuana.

Industrial hemp and marijuana belong to the same genus, Cannabis. Both plants possess the genes to synthesize the drug, tetrahydrocannabinol, or THC, but in different

concentrations. These plants also synthesize other related cannabinoids, such as CBD (cannabidiol), that are not considered drugs.

Industrial hemp is accepted as a fiber-producing agricultural non-drug crop and is grown in over 30 countries throughout the world, including England and neighboring Canada. However, in the United States the Drug Enforcement Administration lists it in Schedule I as a drug plant and prohibits its cultivation. Industrial hemp has a very low THC content of 0.3% THC by weight, or less. It is generally recognized that this very low concentration of THC does not have a drug effect. Marijuana possesses a THC content of 5 to 20% THC (and reportedly as high as 28% THC) and elicits a drug effect.

2. Hemp varieties.

Industrial hemp varieties have been bred and selected for over a hundred years. Russia has numerous varieties with desirable fiber features and grows them under the diverse agricultural conditions of that nation. Likewise, European countries have developed many varieties for growth under their differing ecological conditions between the Mediterranean and Baltic Seas. In Canada, where hemp became legal in 1998, growers initially used European varieties, but now have selected new varieties found to grow well under its different agricultural conditions. At present the Canadian government approves use of over 35 hemp varieties with a content of 0.3% THC or less by weight **(Fig. 1).**

Hemp varieties for cultivation in Wisconsin can be selected initially from those grown in Canada. Additional varieties can be developed in a breeding program to select those for production of enhanced fiber quantity, fiber quality, seed oil and protein production or other traits.

3. Administration of hemp program.

The legislature has outlined a program for hemp cultivation indicating it will establish a rule-making program, perhaps with the Wisconsin Department of Agriculture and Tourism. Various aspects of the final program, perhaps, may be similar to those of other states now cultivating hemp or those formulated in Canada.

Canada has experienced no illicit marijuana planting, or co-mingling, on farms of hemp. Yet, to avoid any possibility of such an occurrence Canada, like European countries, takes precautionary surveillance steps. Farmers must grow certified hemp seed. A farmer must register the precise location of the farm area to be planted in hemp (hemp area of a farm will change yearly because of crop rotation), and the plot will be identified also by GPS. Thus, each farmed area can be surveyed by air or by ground, as desired by law enforcement. No fencing of any kind is necessary for hemp fields. Regulations in states in which hemp can now be grown, in accordance to the 2014 Farm Bill, also can serve as a model for developing a protocol for growing hemp in Wisconsin.

4. Plant growth pattern.

The hemp plant grows as a single stem 6 to 10 feet tall, and taller, with few or no branches before flower development so as to produce stems with long, straight fibers (**Fig 2**). There are approximately 200 plants per square yard; this density results in the lower leaves being shaded out and production of taller plants. Quality hemp results from rapid growth and minimal branch formation because branches result in irregularly shaped fibers of poor quality.

Marijuana is grown as shorter and robust plants, more Christmas tree-like in character, that produce numerous branches. Each of these branches will develop the desired numerous flower clusters that contain abundant glands in which THC is accumulated. Such plants require adequate ground space, 4-6 square feet, and sunlight necessary to develop flowers with abundant glands and enhanced THC content.

Each hemp variety has been genetically selected for uniformity of plant features including growth habit. Thus, plants in a hemp field appear very uniform in character and height when observed from the ground or from the air. This closeness produces quality hemp, and at the same time shades out any weeds in the field. All plants essentially come into flower at the same time.

If marijuana plants are grown in a field of hemp, they are readily recognizable from the ground and air because these plants are spaced widely apart for required sun to produce abundant flowers and glands. In a young field of hemp, the marijuana plants will appear clumpy from the air. Then, as the densely grown hemp plants increase in height and leaf canopy, the hemp will shade out the marijuana. Thus, marijuana plants in hemp fields of all ages in development can be recognized with surveillance on the ground and from the air. Law enforcement officials in Canada and Europe have no difficulty distinguishing between hemp and marijuana.

5. Pollination of hemp and marijuana.

Hemp and marijuana are short-day plants and begin to flower in response to the duration of daylight, or photoperiod, during the growing season. Both plants produce male flowers (with pollen) and female flowers (with eggs--potential seeds). Flowering is induced when the day length begins to shorten late in June. Flowers are produced on specific branches, and new flowers continue to form on these branches for some period of time. Additional such branches with new flowers will form during the flowering period.

The adult parent plants of hemp (0.3% THC) and marijuana (15% THC) retain these same THC concentrations throughout their lifetime; these represent the genic traits for the variety. Cannabis is wind-pollinated. Therefore, the pollen can travel many miles.

Four typical natural crosses between hemp and marijuana varieties can occur in the field. These crosses will transfer the genes for THC production between the two

varieties of plants. The crossing process does not change the THC level in the parent plants. In these crosses only the **genes** for THC concentration are transferred to the embryo and subsequent seed; the mechanism to produce the THC chemical is 'turned on' when the seedling grows into a plant.

1. Pollen from hemp will pollinate female flowers (eggs>seeds) of hemp on farms.
   Cross: hemp **X** hemp (seeds from cross)
2. Pollen from marijuana in the field can pollinate hemp female flowers (eggs>seeds).
   Cross: marijuana **X** hemp (seeds from cross)
3. Pollen from hemp will pollinate female flowers (eggs>seeds) of marijuana in the field.
   Cross: hemp **X** marijuana (seeds from cross)
4. Pollen from marijuana will pollinate female flowers of marijuana in the field.
   Cross: marijuana **X** marijuana (seeds from cross)

Four broad groups of seeds result from these crosses:

1. The hemp **X** hemp cross. These are the seeds formed during cultivation of hemp. All these seeds possess the THC genes characterizing hemp.
2. The marijuana **X** hemp cross. Some such seeds could be produced in the vast fields of hemp. It would be almost impossible to identify such seeds. It would be necessary to grow <u>every seed</u> from a hemp field into an adult plant and analyze every such plant for the concentration of THC to identify this cross; not probable.
3. The hemp **X** marijuana cross. The vast dissemination of hemp pollen will pollinate marijuana out in the field. The genes for hemp-level THC will be transferred to embryo-seeds of this marijuana. Plants grown from these seeds during the next growing season will contain a <u>lower</u> THC content (0.3% THC **X** 15% THC) than in the parent marijuana plant. This is a desirable trait for controlling marijuana.
4. The marijuana **X** marijuana cross. Marijuana plants in the field will cross and the embryo-seed will contain the genes for marijuana level THC. Plants from these seeds in the next growing season will contain 15% THC.

A marijuana grower could collect seed groups 3 and 4, but because so many of them could have been pollinated by hemp, all seeds are suspect. Some to many will contain the genes for low (0.3%) THC.

Conclusions from the above crosses include:

1. A marijuana grower would find it impossible to locate seeds of No. 2 in hemp fields. Farmers will harvest all hemp seeds (No. 1 and 2) for marketing. Since seeds contain only the gene to produce THC, not the THC chemical, all seeds can be marketed.
2. All the marijuana in the field will be included in No. 3 and 4. However, all the seeds collected by a marijuana grower from plants of No. 3 and 4 will be of unknown THC gene character. All these seeds look alike. The marijuana grower will have the impossible task of growing <u>every seed</u> to a plant so as to then analyze each one for its

THC concentration. The marijuana grower will be thwarted in any effort to cultivate marijuana in the field for high THC content when hemp is being grown as a farm crop.

Summary. The above discussion represents the results and impact of only one year's cultivation of hemp by Wisconsin farmers. It emphasizes the role that cultivation of hemp can contribute to the control of illegal marijuana. As described here, all new seeds of marijuana in the field become suspect because marijuana could/will be crossed with hemp, and a percentage of new plants resulting from such crosses could/will contain less THC than the parent marijuana.

We can project, therefore, that routine yearly planting of industrial hemp as an agricultural crop in Wisconsin will impact illicit marijuana throughout the countryside by progressively lowering its THC content and marginalize growing marijuana in Wisconsin as a drug plant.

6. Cannabis secretory glands.

Numerous glands containing a large secretory cavity occur on the plant surfaces, including stem, leaves, bracts (small modified leaves) and floral parts of both hemp and marijuana **(Fig. 3)**. Glands are just visible to the eye. They are most abundant, in fact very abundant, on the bracts associated with flowers. A group of cells at the base of the cavity synthesize the THC (and other cannabinoids) and also produce an abundance of sticky terpene compounds. These cells secrete the THC and terpenes into the large cavity where they accumulate--the cavity is densely filled with these substances along with other materials. The THC is dissolved in the sticky terpenes. Thus, the secretory glands are the sites of THC synthesis; similarly for other cannabinoids and for terpenes, they are formed in the secretory cells of the glands and accumulated in the cavity.

Other cells and parts of the plant do not contain THC. Thus, fiber cells, wood cells, seed coat, seed endosperm and embryo lack THC. However, the nucleus of all cells contains the genes for THC synthesis. In the seed those genes are 'turned on' only after the seed germinates, forms the seedling that develops into the growing plant (the embryo, for example, does not contain THC such as in the adult plant). The concentration of THC, say, 0.3% THC in hemp and 15% THC in marijuana, also is controlled genetically, and more study on this control mechanism is in progress. Thus, secretory glands are the sites of THC synthesis.

7. Glandular THC and plant sampling for THC analyses.

Presence of THC in the terpenes of glands necessitates care when collecting plant tissue for THC analyses so as to avoid falsely detecting THC in samples. When a person collects (touches) any plant portion, glands with their THC in the resinous terpene content will be rubbed off onto fingers (gloves), instruments and collecting bags, and analyses of them will detect THC.

When plant parts, such as branches with mature seeds, are shaken to obtain seeds many glands will break off and mix with the seeds and coat the seed surface with THC in the sticky gland contents. Similarly, readily abscising glands with their THC content will contaminate other plant parts such as pollen, and falsely indicate the presence of THC in pollen grains. Thus, the analyses of gland-contaminated samples, or samples contaminated from THC on a collector's hands or equipment, will yield erroneous data for presence and concentration of THC in samples. Appropriate care must be exercised to avoid contamination of samples with glands that fall onto sample tissues; this may require microscopic examination of samples to determine if they are contaminated with glands or their resinous contents.

8. Industrial applications of hemp; hemp products are biodegradable.

Older Wisconsin farmers are familiar with hemp cultivation prior to its prohibition in the post-World War II era, and with various products then manufactured from hemp. Hemp product development has been prolific in other countries, and we can utilize that information to initiate a hemp-based development program in Kentucky. Fibers remain the major raw material source for cellulose, hurd or the wood is the raw material used to produce animal bedding products and insulation, and seeds are a source of oil, protein and flour for various uses.

In the auto industry (Europe at present, in particular) hemp fiber is used to manufacture lightweight compression molded parts such as dashboards, door and roof liners and similar items to replace those made from heavier fiberglass **(Fig. 4)**. One USA company, Flexform Industries, Elkhart, IN is making the base fiber mats for similar parts for Ford, GM and campers in limited quantities, as well as shells for office equipment **(Fig. 5)**. It also uses other fibers, such as sisal, flax, and kenaf, but considers hemp to be superior because of the strong and extra long fibers.

Mercedes has a program dedicated to developing a bioplastic to replace the metal shell of their cars for use under production-line circumstances. Already new bioplastics of hemp or hemp-flax are used to form the shell of specialty cars. An all-hemp car--its shell and many parts--is manufactured and marketed in Canada **(Fig. 6)**. The concept of an all-fiber (hemp and sisal) car shell was already demonstrated by Henry Ford in about 1938-1940 **(Fig. 7)**.

Perhaps these are prototypes of future cars. In Europe hemp may become the plant of necessity because European companies are urged to manufacture eco-friendly biodegradable or recyclable products. Landfill space is at a premium in Europe. Other foreign auto manufacturers, such as Toyota and Subaru, among others, also have research programs directed to using bioplastics in their products. Compression molded parts using natural fibers and petro-based plasticizers may be recycled or incinerated, while parts made with fiberglass cannot.

We can visualize other new applications for hemp-based bioplastics, such as appliances, which is an important industry in Wisconsin. The kitchen appliance industry may well be able to design and manufacture bio-friendly major as well as small appliances that biodegrade upon disuse.

Hemp can have broad application to produce products for the construction industry in the building materials trade, such as particleboard (where I and two associates demonstrated the production of high quality particleboard from hemp).

Hemp seed oil is a major commodity on the world market. Millions of dollars of hemp oil are imported annually into USA for use in soaps and cosmetics, building materials, food materials, and other applications.

Bioplastics made from cellulosic hemp fibers, or similar cellulose sources, are now recognized as an environmental friendly substrate for producing many products. Coca Cola has developed a bioplastic Plant Bottle that will replace current bottles within a few years, and will be produced in South America. Why not here in the USA?

9. Cannabis publications of Paul G. Mahlberg.

(Next page)

CANNABACEAE PUBLICATIONS OF PROF. PAUL G. MAHLBERG

Tele: 920-839-2536
Email: pmmahlberg@dcwis.com

From over 125 journal articles, and books, films and edited books.

39. Hillig, K. W., and P. G. Mahlberg. 2004. Chemotaxonomic analysis of cannabinoid variation in Cannabis (Cannabaceae). Amer. Jour. Bot. 91: 966-975.

38. Mahlberg, P. G., and E. S. Kim. 2003. Accumulation of cannabinoids in the secretory cavity of Cannabis. Jour. Industr. Hemp 9: 15-36.

37. Kim, E. S., and P. G. Mahlberg. 2003. Secretory vesicle formation in the secretory cavity of glandular trichomes of Cannabis (Cannabaceae). Mol. Cells 15: 387-395.

36. Mahlberg, P. G. 2003. Reintroduction of industrial hemp into American agriculture. Wisconsin Flora 4:3-6.

35. Kim, E. S., and P. G. Mahlberg. 2000. Early development of the secretory cavity of peltate glands in Humulus lupulus L. (Cannabaceae). Mol. Cells 10:487-492.

34. Kim, E. S., and P. G. Mahlberg. 1999. Immunochemical localization of tetrahydrocannabinol (THC) in chemically fixed glandular trichomes of Cannabis (Cannabaceae). Jour. Biol. Sci. 3: 215-219.

33. Hammond, C. T., and P. G. Mahlberg. 1999. Phloroglucinol as a natural phenolic constituent of Humulus lupulus (Cannabaceae). Amer. J. Bot. 87: 2105.

32. Kim, E. S., and P. G. Mahlberg. 1997. Cytochemical localization of cellulase activity associated with secretory cavity formation in glandular trichomes of Cannabis (Cannabaceae). Jour. Plant Biol. 40: 61-66.

31. Kim, E. S., and P. G. Mahlberg. 1997. Plastid development in glandular trichomes of Cannabis (Cannabaceae). Mol. Cells 7: 352-359.

30. Kim, E. S., and P. G. Mahlberg. 1997. Immunochemical localization of tetrahydrocannabinol (THC) in cryofixed glandular trichomes of Cannabis (Cannabaceae). Amer. J. Bot. 83: 336-342.

29. Kim, E. S., and P. G. Mahlberg. 1995. Glandular cuticle formation in Cannabis (Cannabaceae). Amer. J. Bot. 82: 1207-1214.

28. Hammond, C.T., and P. G. Mahlberg. 1994. Phloroglucinol glucoside as a natural constituent of Cannabis sativa. Phytochemistry 37: 755-756.

27. Mahlberg, P. G., and E. S. Kim. 1992. Secretory vesicle formation in glandular trichomes of Cannabis sativa L. (Cannabaceae). Amer. J. Bot. 79:166-173.

26. Mahlberg, P. G., and E. S. Kim. 1991. Cuticle development on glandular trichomes of Cannabis L. (Cannabaceae). Amer. J. Bot. 78:1113-1122.

25. Kim, E. S., and P. G. Mahlberg. 1991. Secretory cavity development of glandular trichome of Cannabis sativa L. (Cannabaceae). Amer. J. Bot. 78:142-151.

24. Hammond, C. T., and P. G. Mahlberg. 1990. Thin-layer chromatographic identification of phenol in the glandular secretory system of Cannabis sativa L. (Cannabaceae). Ind. Acad. Sci. 98:201-209.

23. Turner, J., and P. G. Mahlberg. 1988. In vivo incorporation of labeled precursors into cannabinoids in seedlings of Cannabis sativa L. (Cannabaceae) pp. 263-270. In, G. Chesher, P. Consroe and R. Musty (eds.), Marihuana. Australian Gov't. Publ.

22. Vogelmann, A., J. Turner, and P. G. Mahlberg. 1988. Cannabinoid composition in seedlings compared to adult plants of Cannabis sativa. J. Nat. Prod. 51:1075-1079.

21. Vogelmann, A., J. Turner, and P. G. Mahlberg. 1987. Cannabinoid occurrence in seedlings of Cannabis sativa L.: Quantitation in seedlings of known age and primary leaf length. Bot. Gaz. 148:468-477.

20. Turner, J., P. G. Mahlberg, V. Lanyon, and J. Pleszczynska. 1985. A temporal study of cannabinoid composition in continual clones of Cannabis sativa L. (Cannabaceae). Bot. Gaz. 146:32-38.

19. Vogelmann, A., J. Turner, and P. G. Mahlberg. 1984. Sequential appearance of cannabinoids during seedling development in Cannabis sativa L., pp. 18-23. In: Marihuana, D. Harvey (ed.). IRL Press, Oxford, UK.

18. Turner, J., and P. G. Mahlberg. 1984. Effects of sample treatment on chromatographic analysis of cannabinoids in Cannabis sativa L. (Cannabaceae). J. Chromatogr. 283:165-171.

17. Turner, J., and P. G. Mahlberg. 1984. Separation of acid and neutral cannabinoids in Cannabis sativa L. using HPLC, pp. 79-88. In: "Biology of Cannabinoids," W. Dewey, S. Agurell, and R. Willette (eds.). Academic Press, N.Y.

16. Mahlberg, P. G., J. Turner, J. Hemphill, and C. Hammond. 1984. Ultrastructure, development and composition of glandular trichomes of Cannabis, pp. 23-51. In: Biology and Chemistry of Plant Trichomes, E. Rodriguez, P. Healey, and I. Mehta (eds.). Pergamon Press, New York.

15. Mahlberg, P. G., and J. Hemphill. 1983. The effect of light quality on cannabinoid composition of Cannabis sativa L. (Cannabaceae). Bot. Gaz. 144:43-48.

14. Turner, J. and P. G. Mahlberg. 1982. Simple high-performance liquid chromatographic method for separating acidic and neutral cannabinoids in Cannabis sativa L. Jour. Chromatogr. 253:295-303.

13. Turner, J., J. Hemphill, and P. G. Mahlberg. 1982. Interrelationships of glandular trichomes and cannabinoid content. II. Developing leaves of Cannabis sativa L. (Cannabaceae). Bull. on Narc. 33:63-71.

12. Furr, M. and P. G. Mahlberg. 1981. Histochemical analyses of unbranched non articulated laticifers and capitate glandular hairs in Cannabis sativa L. (Cannabaceae). Jour. Nat. Prod. 41:153-159.

11. Lanyon, V., J. Turner, and P. G. Mahlberg. 1981. Quantitative analysis of cannabinoids in the secretory product from capitate-stalked glands of Cannabis sativa L. (Cannabaceae). Bot. Gaz. 142:316-319.

10. Turner, J., J. Hemphill, and P. G. Mahlberg. 1981. Interrelationships of glandular trichomes and cannabinoid content. I: Developing pistillate bracts of Cannabis sativa L. (Cannabaceae). Bull. on Narc. 33:59-69.

9. Hemphill, J., J. Turner, and P. G. Mahlberg. 1980. Cannabinoid content of individual plant organs from different geographical strains of Cannabis sativa L. (Cannabaceae). Jour. Nat. Prod. 43:112-122.

8. Turner, J., J. Hemphill, and P. G. Mahlberg. 1980. Trichomes and cannabinoid content in developing leaves and bracts of Cannabis sativa L. (Cannabaceae). Amer. J. Bot. 67:1397 1406.

7. Hammond, C. and P. G. Mahlberg. 1978. Ultrastructural development of capitate glandular hairs of Cannabis sativa L. (Cannabaceae). Amer. J. Bot. 65:140-151.

6. Turner, J., J. Hemphill, and P. G. Mahlberg. 1978. Studies on growth and cannabinoid composition of callus derived of Cannabis sativa. Lloydia 41:453-462.

5. Turner, J., J. Hemphill, and P. G. Mahlberg. 1978. Quantitative determination of cannabinoids in individual glandular trichomes of Cannabis sativa L. (Cannabaceae). Amer. J. Bot. 65:1103-1106.

4. Turner, J., J. Hemphill, and P. G. Mahlberg. 1978. Cannabinoid composition and gland distribution in clones of Cannabis sativa L. Bull. on Narc. 30:55-65.

3. Hammond, C. and P. G. Mahlberg. 1977. Morphogenesis of capitate glandular hairs of Cannabis sativa L. (Cannabaceae). Amer. J. Bot. 64:1023-1031.

2. Turner, J., J. Hemphill, and P. G. Mahlberg. 1977. Gland distribution and cannabinoid content in clones of Cannabis sativa. Amer. J. Bot. 64:687-693.

1. Hammond, C. and P. G. Mahlberg. 1973. Morphology for glandular hairs of Cannabis sativa L. from scanning electron microscopy. Amer. J. Bot. 60:524-528.

Figure 1. List of approved hemp varieties for cultivation in Canada.

List of Approved Cultivars for the 2012 Growing Season

Industrial Hemp Regulations
Cannabis sativa L.

Help on accessing alternative formats, such as Portable Document Format (PDF), Microsoft Word and PowerPoint (PPT) files, can be obtained in the alternate format help section.

(PDF Version - 94 K)

Pursuant to Subsection 39(1) of the *Industrial Hemp Regulations*, the following industrial hemp varieties are approved for commercial cultivation under licence for the year 2012. The list may contain variety names that are synonyms for the same variety.

List of Approved Cultivars

Variety	Country where Maintained	Exempt from THC testing under subsection 16(1) of the *Industrial Hemp Regulations*[*]
Alyssa	Canada	Exempt in Manitoba only
Anka	Canada	Exempt in Ontario and Quebec only
Canda	Canada	No
CanMa	Canada	No
Carmagnola	Italy	No
Carmen	Canada	No
CFX-1	Canada	No
CFX-2	Canada	No
Crag	Canada	Yes
CRS-1	Canada	No
C S	Italy	No
Delores	Canada	No
Deni	Canada	No
ESTA-1	Canada	No
Fasamo	Germany	No

[*] Samples will be taken by inspectors designated under the CDSA for routine variety monitoring.

[**] Denotes variety under observation.

Variety	Country where Maintained	Exempt from THC testing under subsection 16(1) of the *Industrial Hemp Regulations*[*]
Fedrina 74	France	No
Felina 34	France	No
Ferimon	France	No
Fibranova	Italy	No
Fibriko	Hungary	No
Fibrimon 24	France	No
Fibrimon 56	France	No
Finola	Canada (Finland)	No
Joey	Canada	No
Jutta	Canada	No
Kompolti	Hungary	No
Kompolti Hibrid TC	Hungary	No
Kompolti Sargaszaru	Hungary	No
Lovrin 110	Romania	No
Petera	Canada	No
Silesia	Canada	No
UC-RGM	Canada	No
Uniko B	Hungary	No
USO 14	Canada (Ukraine)	Yes
USO 31	Canada (Ukraine)	Yes
X59(Hemp Nut)	Canada	No
Yvonne	Canada	No
Zolotonosha 11	Canada (Ukraine)	Exempt in MB only
Zolotonosha 15	Canada (Ukraine)	No

[*] Samples will be taken by inspectors designated under the CDSA for routine variety monitoring.

[**] Denotes variety under observation.

All cultivars may be grown in all regions, however requirements for THC testing under Subsection 16(1) of the IHR may vary from province to province, as indicated in the table above.

Amendments to the List of Approved Cultivars for 2012

Additions: One variety, Silesia was added to the list this year.

Deletions: No varieties were removed from the list this year.

Observation: The variety *Finola*, remains under observation. Sampling and monitoring of production, as well as, a thorough verification of eligible parent seed planted will continue in

2012.

Please Note:

Subsection 14(3) of the *Industrial Hemp Regulations* (IHR) requires that all seed planted for the production of industrial hemp in Canada must be of pedigreed status (Certified or better). This means that seed cannot be imported directly from countries that are not recognized by one of the Seed Certification Schemes of which Canada is a member. Canada is a member of two schemes, the Organization for Economic Cooperation and Development Seed Scheme (OECD) and that administered by the Association of Official Seed Certifying Agencies (AOSCA). Farmer-saved seed cannot be planted, unless it is Certified seed. Official seed tags will be requested by an inspector as evidence of compliance.

Under Subsection 16(1) of the IHR, a person who holds a licence to cultivate industrial hemp is required by law to have their crop sampled by an authorized Crop Sampler, unless the variety is specifically exempted from this testing. Sampling by a designated inspector does not exempt a licence holder from this testing. The sample taken by the authorized Crop Sampler must be tested by a competent laboratory, licensed for testing industrial hemp. A list of licensed laboratories is available on our website. Test results must be reported to the Office of Controlled Substances, at the address below. Varieties which are found to consistently exceed 0.3% THC may be removed from the *List of Approved Cultivars*.

Three varieties, USO 14, USO 31 and Crag are exempted from annual testing as required under paragraph 16(1) of the IHR for **all regions of Canada**. The varieties Alyssa, Anka, and Zolotonosha 11 are only exempt in the provinces indicated in the table above. All varieties have been evaluated against the *Policy on the Exemption of Industrial Hemp Varieties from THC Testing During the Growing Season*. A copy of this policy can be found on our website at www.healthcanada.gc.ca/hemp.

The Office of Controlled Substances must be informed immediately in writing in the event of crop failure where samples cannot be drawn for testing.

Questions regarding the List of Approved Cultivars - 2012 may be submitted to:

Industrial Hemp Section
Office of Controlled Substances
Controlled Substances and Tobacco Directorate
Healthy Environments and Consumer Safety Branch
123 Slater Street A.L. 3502A
Ottawa, ON K1A 1B9
Phone: (613) 954-6524
Fax: (613) 941-5360
Email: [redacted]

Original signed by Johanne Beaulieu
Director
Office of Controlled Substances

2012-03-27
Date

Results of THC Testing for 2011: All Varieties

	Variety Name	Number of Samples	THC range (%)	Average	Number of samples over 0.3%
	Alyssa	6	0.03-0.22	0.10	-
	Anka	14	0.09-0.26	0.16	-
	Canda	2	0.05-0.06	0.06	-
	CanMa	6	0.06-0.15	0.09	1
	Crag	1	0.08	0.08	-
	CFX-1	59	0.02-0.45	0.11	2
	CFX-2	14	0.03-0.19	0.09	-
	CRS-1	66	0.03-0.26	0.09	-
	Delores	16	0.02-0.12	0.06	-
10	*Finola*	53	0.06-0.47	0.17	5
	Jutta	2	0.02-0.11	0.07	-
	USO 14	3	0.02-0.07	0.04	-
	USO 31	2	0.01	0.01	-
14	*X-59 (Hemp Nut)*	9	0.03-0.14	0.08	-

Results as of January 28, 2012 as reported to the Office of Controlled Substances by both Health Canada and private laboratories.

Date Modified: 2012-10-15

Figure 2. Hemp stem showing the long fibers of the bark and the woody core.

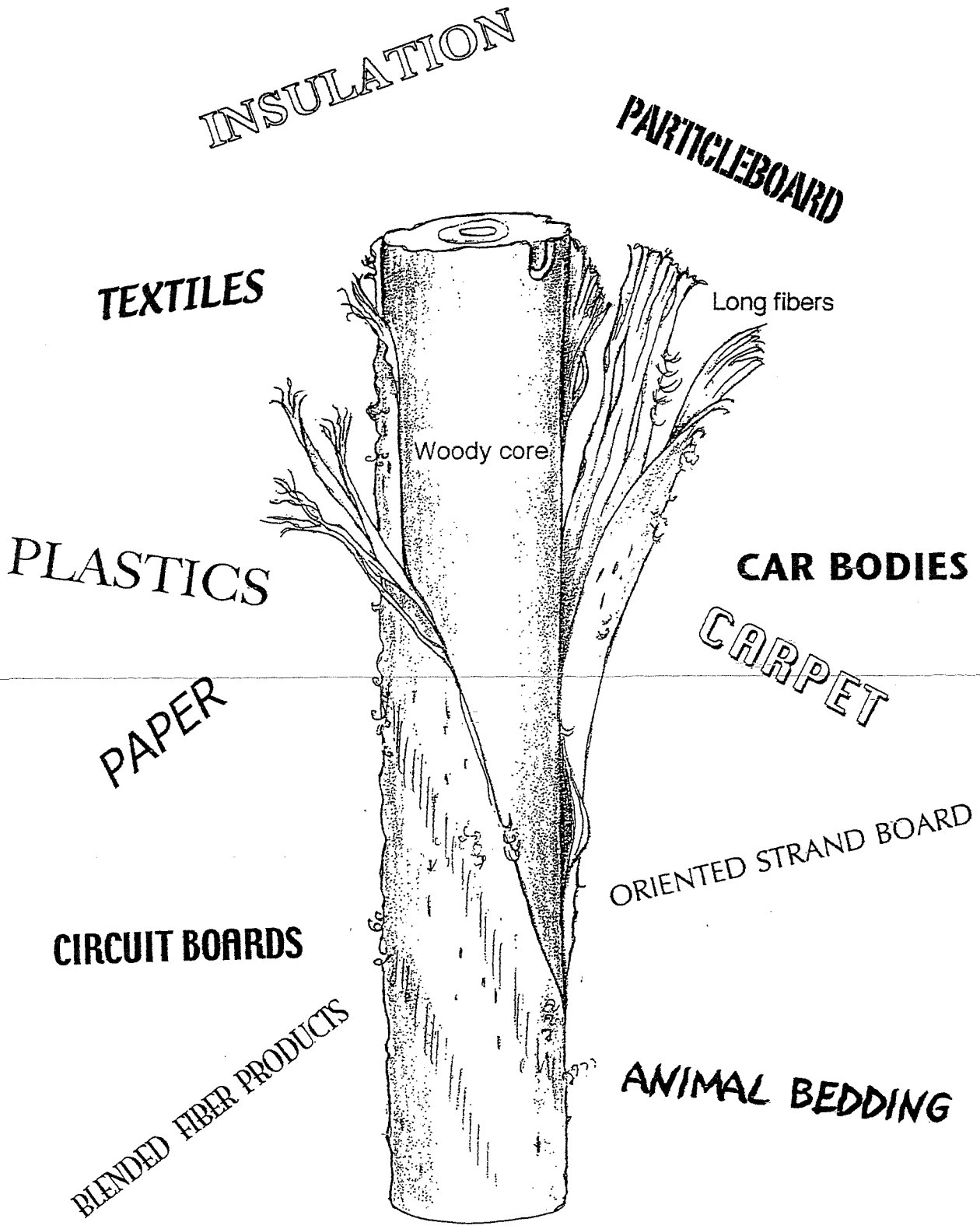


Figure 3. Glands and gland features of Cannabis (sub-figures 1 to 4).

FIGURES 1-4. Secretory glands. **1.** Capitate-stalked and capitate-sessile glands on underside of bract. Hairs also are present on bract ×35. **2.** Capitate-stalked gland showing large head (star) and abscission zone at base of gland head (curved arrow) ×300. **3.** Section of gland head showing relationships of secretory cavity (S), disc cells (D), cuticle (E) and subcuticular wall (arrow). Vesicles (V) occur in secretory cavity and secretions occur in disc cell just below the wall (W, and at X). Bar = 0.5 µm. **4.** Portion of gland showing two disc cells, one at D, each with numerous lipoplasts (P) containing secretions (black). Portion of secretory cavity (S) is evident. Fibrillar matrix (arrow) has separated from wall. Bar = 0.5 µm.

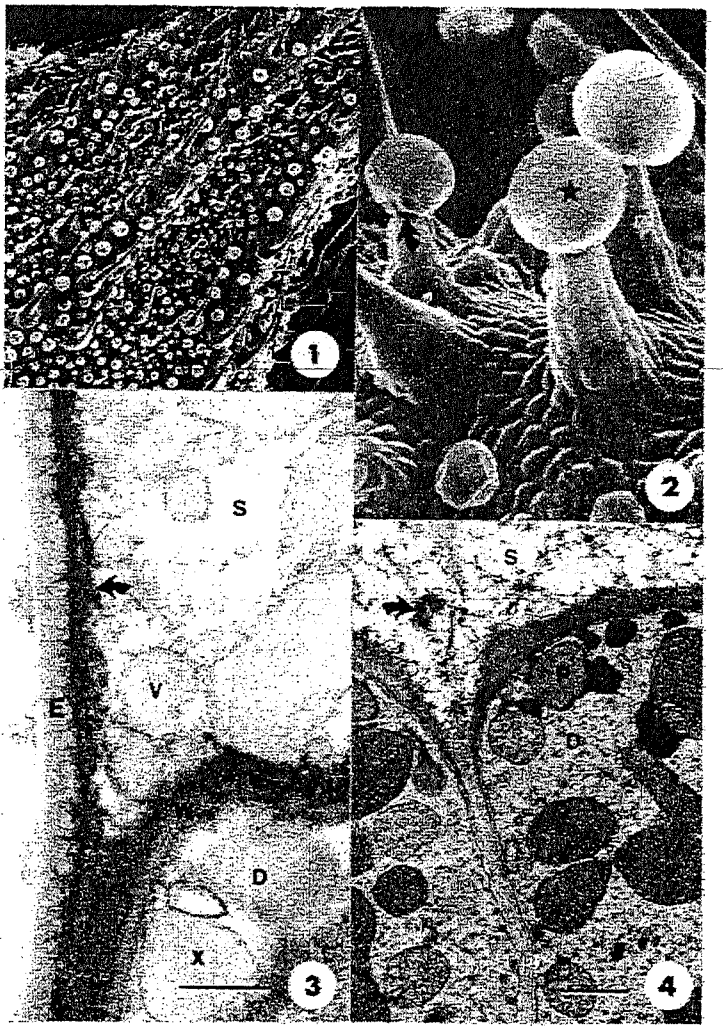
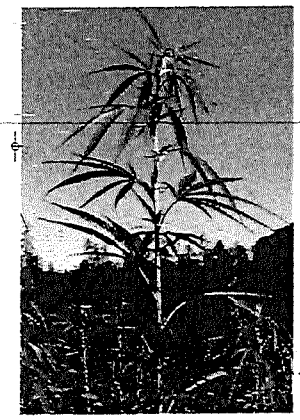
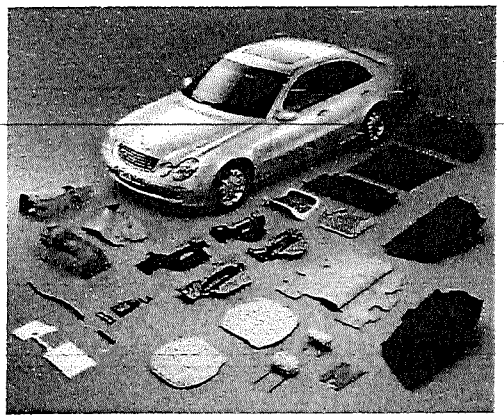


Figure 4. Automobile components made from hemp by European manufacturers.

Eco-friendly cars need sustainable materials

Use European Hemp Fibres for bio-composites in light weight construction

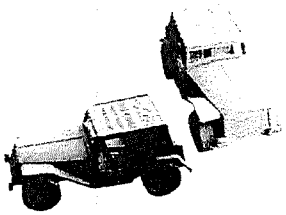




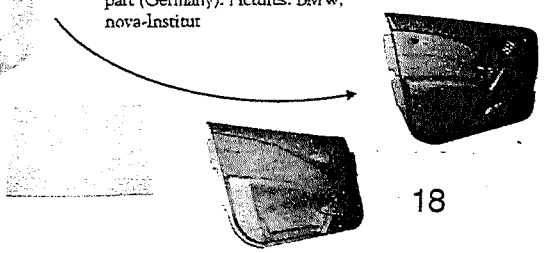
50 Natural fibre parts for Mercedes E-Class (Germany).
Picture: Daimler AG

Sports car Lotus Eco Elise, in the main made from different natural-fibre compounds, hand lay-up, vacuum bagging and RTM (UK). Pictures: Lotus Cars

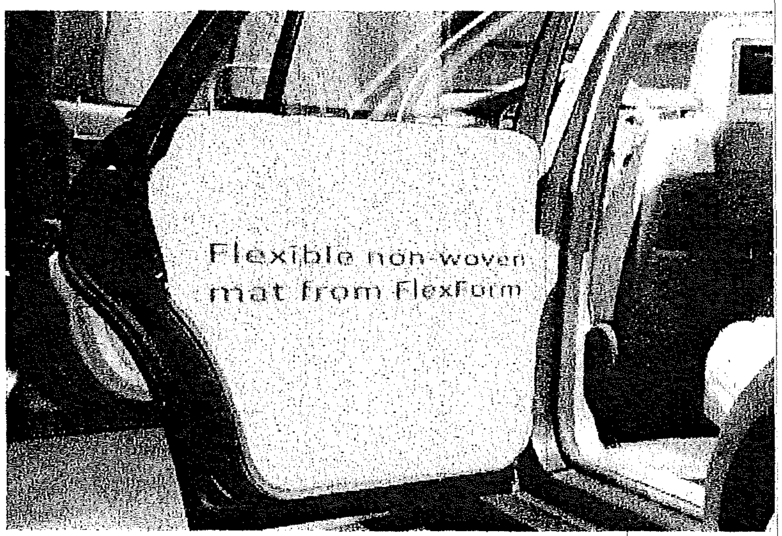
Natural fibre door panel for BMW 5 Series, compression moulded part (Germany). Pictures: BMW, nova-Institut



Toy cars, natural fibre and Polypropylen, injection moulding (The Netherlands). Picture: GreenGran



FlexForm TECHNOLOGIES



FlexForm is the lightweight champion of the world.

We have taken on the challenge of the world's auto manufacturers and engineered door, console, ceiling and other panels that are 1) lighter – increasing fuel efficiency and reducing shipping and handling and 2) recyclable – factory trim is recovered and sustainable parts can be recycled at end of use. Our one step 3-D molding platform is a perfect fit for Tier 1 suppliers.

GM Ford HONDA CHRYSLER

and the light one is powered by FlexForm.

Figure 5. Fiber-based (including hemp) products manufactured by FlexForm for cars.

Figure 6. Car manufactured from hemp and other fibers by Motive Inc. in Canada.

An Electric Car Made from Hemp

Categories:

- Energy
- Green Living
- Technology

By Michele Berger
02/23/2011

This car's made from hemp and other fibers. (Photo: Motive Inc.)

Soon, you'll be able to drive hemp. Literally. And guess what the car'll be called? Kestrel, after the raptor with the same moniker.

Right now, Canadian company Motive Industries, Inc., is testing the materials for a biocomposite hybrid electric car made from hemp and other natural and synthetic fibers. If all goes according to plan, Motive will finish its prototype mid-2011, and make the car available to the public in late-2012 or -2013, according to Nathan Armstrong, Motive's president.

The four-passenger, three-door electric vehicle—created, Armstrong says, to showcase new automotive technology coming out of Canada—can reach speeds of almost 85 mph. It's the result of Project Eve, a for-profit collaboration aimed at combining "Canadian skills for the purpose of producing and supporting Canadian electric vehicles and components," according to Project Eve's website.

The Kestrel's a solid step in that direction. "It won't have any smell. It should be quieter. It should be

(Photo: Motive Inc.)

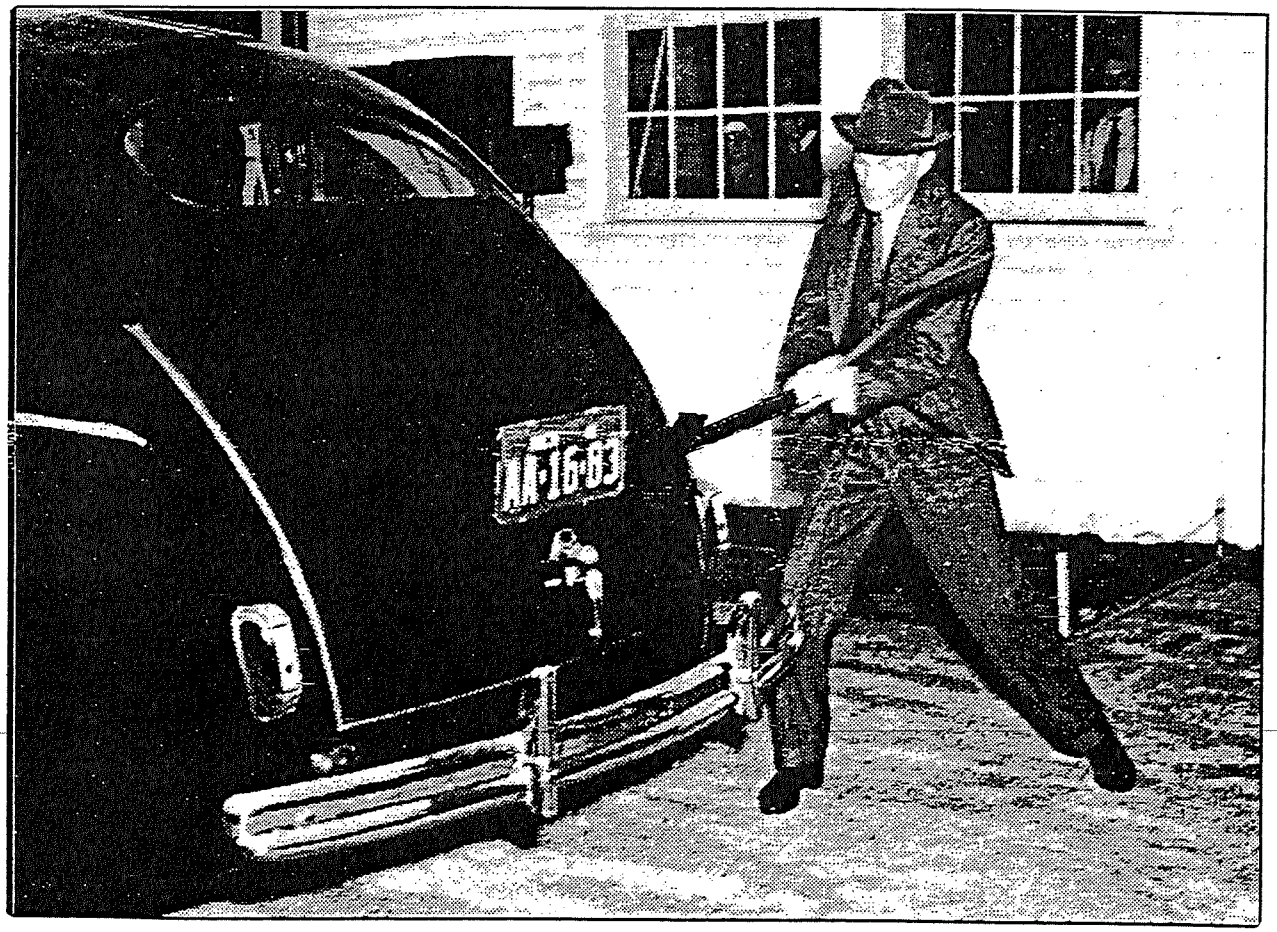


Figure 7. Henry Ford shows the strength of a unique car body built from hemp and sisal cellulosic plastic, as he strikes it with an axe demonstrating his vision to "grow automobiles from the soil".

Wisconsin Farm Bureau FEDERATION

1241 John Q. Hammons Drive P.O. Box 5550, Madison, WI 53705 1.800.261.FARM (3276) www.WFBF.com

Senate Committee on Agriculture, Small Business and Tourism
October 10, 2017
Testimony on Senate Bill 119
Industrial Hemp

Good afternoon Chairman Moulton and members of the committee –

My name is Rob Richard and I am Senior Director of Governmental Relations for the Wisconsin Farm Bureau Federation (WFBF). I am here to submit WFBF's support for Senate Bill 119, relating to the growing and processing of industrial hemp.

In December of 2016, the voting delegates at our annual WFBF meeting took an official position on industrial hemp by passing a resolution stating "We support the production, processing, commercialization and utilization of industrial hemp and that it be regulated by USDA rather than the Drug Enforcement Administration (DEA)." This policy position mirrors what the American Farm Bureau Federation adopted in 2014.

Since that time, WFBF has been actively engaged in working with the bill authors to secure passage of Senate Bill 119, and its companion Assembly Bill 183, but we haven't stopped there.

Even though many states have legalized hemp cultivation, federal authorities have interpreted federal law so that the interstate commerce of hemp seed and potentially some hemp byproduct is illegal. What this means is that states that have passed hemp legislation are hemp islands that cannot transport/sell seed out of the state to be cultivated elsewhere. Introduced by Congressman James Comer of Kentucky, and cosponsored by Wisconsin Representatives Glenn Grothman, Mark Pocan, Ron Kind, Gwen Moore and Mike Gallagher, HR 3530 would classify industrial hemp as it should be - a crop.

As much as American farmers need HR 3530 to be signed into law, we still need a regulatory framework for industrial hemp in Wisconsin that allows farmers to plant and grow it, processors to manufacture it, and universities to research its possibilities. Since the passage of the 2014 Farm Bill, over thirty statehouses across the country have openly accepted industrial hemp's potential as a sustainable, eco-friendly and profitable crop. We need to join them.

Last week WFBF sent all committee members a 12-page feature article from the Wisconsin Historical Society that tells a great story about Wisconsin's dominance of the hemp industry in the mid-20th century. Senate Bill 119 seeks to position ourselves at the national forefront of hemp cultivation, manufacturing and research. It's time that we once again embrace our hemp heritage and revitalize a dormant industry that has so much potential in the 21st century.

WFBF respectfully requests that you support Senate Bill 119.

Return to Hemp Reports

Hemp and Marijuana:

Myths & Realities

by David P. West, Ph.D.

for the North American Industrial Hemp Council

About the Author: Dr. West holds a Ph.D. in Plant Breeding from the University of Minnesota and has spent 18 years as a commercial corn breeder. Since 1993 he has served as an advisor to the emerging hemp industry regarding industrial hemp germplasm. His work, "Fiber Wars: the Extinction of Kentucky Hemp" (1994), a pioneering discussion of the functional difference between hemp and marijuana, and his other writings on hemp and agriculture are available online (CLICK HERE).

Dr. West can be contacted by email at:

davewest@pressenter.com

The complete text of this report is available on the NAIHC website.

This report is the first in a series of white papers produced by:

North American Industrial Hemp Council

Post Office Box 259329

Madison, Wisconsin 53725-9329

Tel: (608) 835-0428

Email: sholtea@wheel.datcp.state.wi.us

website: www.naihc.org

Hemp and Marijuana

Myths & Realities

Abstract

Surely no member of the vegetable kingdom has ever been more misunderstood than hemp. For too many years, emotion-not reason-has guided our policy toward this crop. And nowhere have emotions run hotter than in the debate over the distinction between industrial hemp and marijuana. This paper is intended to inform that debate by offering scientific evidence, so that farmers, policymakers, manufacturers, and the general public can distinguish between myth and reality.

Botanically, the genus *Cannabis* is composed of several variants. Although there has been a long-standing debate among taxonomists about how to classify these variants into species, applied plant breeders generally embrace a biochemical method to classify variants along utilitarian lines. *Cannabis* is the only plant genus that contains the unique class of molecular compounds called cannabinoids. Many cannabinoids have been identified, but two preponderate: THC, which is the psychoactive ingredient of *Cannabis,* and CBD, which is an antipsychoactive ingredient. One type of *Cannabis* is high in the psychoactive cannabinoid, THC, and low in the antipsychoactive cannabinoid, CBD. This type is popularly known as marijuana. Another type is high in CBD and low in THC. Variants of this type are called industrial hemp.

In the United States, the debate about the relationship between hemp and marijuana has been diminished by the dissemination of many statements that have little scientific support. This report examines in detail ten of the most pervasive and pernicious of these myths.

Myth: United States law has always treated hemp and marijuana the same.

Reality: The history of federal drug laws clearly shows that at one time the U.S. government understood and accepted the distinction between hemp and marijuana.

Myth: Smoking industrial hemp gets a person high.

Reality: The THC levels in industrial hemp are so low that no one could get high from smoking it. Moreover, hemp contains a relatively high percentage of another cannabinoid, CBD, that actually blocks the marijuana high. Hemp, it turns out, is not only not marijuana; it could be called "antimarijuana."

Myth: Even though THC levels are low in hemp, the THC can be extracted and concentrated to produce a powerful drug.

Reality: Extracting THC from industrial hemp and further refining it to eliminate the preponderance of CBD would require such an expensive, hazardous, and time-consuming process that it is extremely unlikely anyone would ever attempt it, rather than simply obtaining high-THC marijuana instead.

Myth: Hemp fields would be used to hide marijuana plants.

Reality: Hemp is grown quite differently from marijuana. Moreover, it is harvested at a different time than marijuana. Finally, cross-pollination between hemp plants and marijuana plants would significantly reduce the potency of the marijuana plant.

Myth: Legalizing hemp while continuing the prohibition on marijuana would burden local police forces.

Reality: In countries where hemp is grown as an agricultural crop, the police have experienced no such burdens.

Myth: Feral hemp must be eradicated because it can be sold as marijuana.

Reality: Feral hemp, or ditchweed, is a remnant of the hemp once grown on more than 400,000 acres by U.S. farmers. It contains extremely low levels of THC, as low as .05 percent. It has no drug value, but does offer important environmental benefits as a nesting habitat for birds. About 99 percent of the "marijuana" being eradicated by the federal government-at great public expense-is this harmless ditchweed. Might it be that the drug enforcement agencies want to convince us that ditchweed is hemp in order to protect their large eradication budgets?

Myth: Those who want to legalize hemp are actually seeking a backdoor way to legalize marijuana.

Reality: It is true that many of the first hemp stores were started by industrial-hemp advocates who were also in favor of legalizing marijuana. However, as the hemp industry has matured, it has come to be dominated by those who see hemp as the agricultural and industrial crop that it is, and see hemp legalization as a different issue than marijuana legalization. In any case, should we oppose a very good idea simply because some of those who support it also support other ideas with which we disagree?

Myth: Hemp oil is a source of THC.

Reality: Hemp oil is an increasingly popular product, used for an expanding variety of purposes. The washed hemp seed contains no THC at all. The tiny amounts of THC contained in industrial hemp are in the glands of the plant itself. Sometimes, in the manufacturing process, some THC- and CBD-containing resin sticks to the seed, resulting in traces of THC in the oil that is produced. The concentration of these cannabinoids in the oil is infinitesimal. No one can get high from using hemp oil.

Myth: Legalizing hemp would send the wrong message to children.

Reality: It is the current refusal of the drug enforcement agencies to distinguish between an agricultural crop and a drug crop that is sending the wrong message to children.

Myth: Hemp is not economically viable, and should therefore be outlawed.

Reality: The market for hemp products is growing rapidly. But even if it were not, when has a crop ever been outlawed simply because government agencies thought it would be unprofitable to grow?

Hemp and Marijuana

Myths & Realities

A Botanical and Biochemical Introduction

Hemp. Has there ever been a plant so fraught with confusion and controversy? The word itself carries a confusing history. "Hemp" was for medieval Europeans a generic term used to describe any fiber [1]. With European expansion, fiber plants encountered during exploration were commonly called "hemp." Thus we have a bewildering variety of plants that carry the name hemp: Manila hemp (abacá, *Musa textilis*), sisal hemp (*Agave sisalana*), Mauritius hemp (*Furcraea gigantea*), New Zealand hemp (*Phormium tenax*), Sunn hemp (*Crotalaria juncea*), Indian hemp (jute, *Corchorus capsularis* or *C. clitorus*), Indian hemp (*Apocynum cannabinum*), bow-string hemp (*Sansevieria cylindrica*) [2].

This botanical confusion was compounded by the introduction of a new word to describe hemp-marihuana (now commonly written "marijuana"). The word was first coined in the 1890s, but was adopted by the Bureau of Narcotics in the 1930s to describe all forms of *Cannabis* and to this day U.S. drug enforcement agencies continue to call the plant marijuana without regard to botanical distinctions. Indeed, a recent conference held in Jefferson City, Missouri and sponsored by Drug Watch International and the Drug Enforcement Administration was entitled, "Marijuana: Myths, Concerns, Facts"-yet much of the discussion concerned industrial hemp and the legal products made from it.

The conflation of the word "marijuana" and the word "hemp" has placed a heavy burden on public policymakers. Many believe that by legalizing hemp they are legalizing marijuana. Yet in more than two dozen other countries, governments have accepted the distinction between the two types of *Cannabis* and, while continuing to penalize the growing of marijuana, have legalized the growing of industrial hemp. The U.S. government remains unconvinced.

To understand the difference between hemp and marijuana, let's begin with two botanical analogies: field corn and sweet corn; breadseed poppies and opium poppies.

Field Corn and Sweet Corn

For crops less encumbered by polemic than hemp is, functional distinctions among varieties are commonly recognized. Consider the case of field corn and sweet corn. The untrained observer cannot tell the different varieties apart just by looking, Both belong to the genus *Zea mays*. But if a grocer attempted a substitution, he would hear complaints. Your average consumer will recognize the difference. And when sweet corn is planted too near field corn, the resulting cross-pollination reduces the sweetness of the former. Companies like Green Giant that grow huge acreages of sweet corn for canning go to great lengths to ensure that an adequate distance separates their fields from corn destined for the grain elevator, or they grow the different varieties at different times. Either way, pollen carrying the dominant gene for starch synthesis is kept clear of cornsilks borne on plants of the recessive (sweet) variety.

Commercial producers of planting seed of either variety are very careful to preserve the genetic integrity of their lines from contamination by other varieties. Their genetic resources are assemblages of optimized characteristics-yield, disease resistance, maturity-created through substantial research investment. Breeders of these crops rigorously ensure that their breeding stocks do not become contaminated by the other type, as this would result in a serious decline in the quality factors each tries to enhance.

This botanical distinction is reflected even in the academic disciplines that deal with corn. Go to a midwestern land grant university's agriculture college and ask to speak to a plant breeder about sweet corn and you will be sent to the horticulture department; for field corn you will be directed to the agronomy department.

A similar situation exists with respect to poppies, the popular garden flower of which there are dozens of variants. Recently the U. S. Drug Enforcement Administration has been cracking down on one specific poppy variety grown in backyards for many years, because it says that opium can be extracted from it. Yet the DEA still considers it legal for gardeners to continue to cultivate the many other varieties of *Papaver somniferum*, even though these are not botanically distinct from the poppy variety that has been outlawed. In similar fashion, the so-called "breadseed poppy" is also a member of the same species, yet the Controlled Substances Act specifically sets aside the poppy seed because of the culinary market [3].

With corn and poppies, we can understand the distinctions among varieties and strains. Until recently, as we shall see, the federal government also recognized the distinctions among the different varieties of *Cannabis*.

Now let's move from analogy to the real thing by examining in more detail the genus *Cannabis*.

The Genus *Cannabis*: Taxonomy and Biochemistry

Scientists who were the first to study the genus *Cannabis* clearly discerned different species. The father of plant taxonomy, Linnaeus, officially designated the *Cannabis* genus in 1753 when he founded the binomial system of botanical nomenclature still used today [4]. Linnaeus added the "sativa" appellation (literally, "sown" or "cultivated," i.e., used in agriculture), indicating the utilitarian nature of the plant. Since his time numerous attempts have been made for a coherent taxonomy of *Cannabis*. Species designations have come and gone [5].

In 1889, botanist and plant explorer George Watt wrote about the distinction between types of *Cannabis*: "A few plants such as the potato, tomato, poppy and hemp seem to have the power of growing with equal luxuriance under almost any climatic condition, changing or modifying some

important function as if to adapt themselves to the altered circumstance. As remarked, hemp is perhaps the most notable example of this; hence, it produces a valuable fibre in Europe, while showing little or no tendency to produce the narcotic principle which in Asia constitutes its chief value."[6]

Dr. Andrew Wright, an agronomist with the University of Wisconsin's Agriculture Experiment Station and steward of the Wisconsin hemp industry during the first half of the twentieth century, wrote in 1918, "There are three fairly distinct types of hemp: that grown for fiber, that for birdseed and oil, and that for drugs." [7]

Although these early analysts discerned clear differences among hemp types, taxonomists have had a difficult problem in deciding how to reflect those differences [8].

The key *Cannabis* species problem derives from the fact that there is no convenient species barrier between the varying types that would allow us to draw a clear line between them. In taxonomy, often the delineating line between species is that they cannot cross-breed. But disparate types of *Cannabis* can indeed produce fertile offspring, not sexually dysfunctional "mules."

Consequently, a debate has raged within botanical circles as to how many species the genus contains. At this time botanists generally recognize a unique family of plants they call "Cannabaceae," under which are classified the genus *Cannabis* and its closest botanical relative, *Humulus*, which contains the beer flavoring, hops [9]. The prevailing opinion currently recognizes three species: *C. sativa*, *C. indica*, and *C. ruderalis*. [10] "Industrial" types fall exclusively within *C. sativa*, although all *Cannabis* plants contain stem fiber and can have multiple uses in primitive societies where they are indigenous.

Recent analytical advances are leading many scientists to believe that a more accurate and satisfying way to differentiate the different forms of *Cannabis* would be by their biochemical composition.

Cannabis is the only plant genus in which can be found the unique class of molecules known as cannabinoids. *Cannabis* produces two major cannabinoids-THC (delta-9 tetrahydrocannabinol) and CBD (cannabidiol), and several other minor cannabinoid compounds.

THC is responsible for the psychoactive effect [11]. That was demonstrated conclusively in the 1960s. CBD, on the other hand, has recently been shown to block the effect of THC in the nervous system.

Cannabis strains of the type used for industrial purposes have relatively high levels of CBD versus THC. Drug strains are high in THC and low to intermediate in CBD [12]. Smoking hemp, high in CBD and very low in THC, actually has the effect of preventing the marijuana high [13]. Even when the amount of THC in a sample is as high as 2 percent, the psychological high is blocked by as little as 2 percent CBD [14].

Cannabis with THC below 1.0 percent and a CBD/THC ratio greater than one is therefore not capable of inducing a psychoactive effect. Hemp, it turns out, is not only not marijuana, it could be called "antimarijuana."

The balance of cannabinoids is determined by the genetics of the plant. That it is a stable characteristic of a given genotype (i.e., the individual's specific genetic complement) was demonstrated by Dr. Paul Mahlberg of Indiana University-Bloomington [15]. In other words, plants do not capriciously alter their cannabinoid profile.

Thus, using the chemotype approach, *Cannabis* variants can be classified on the basis of their THC-CBD balance. This is accepted by a growing number of scientists. Gabriel Nahas, M.D., Ph.D., writes, "One should still distinguish two principal large groups of varieties of *Cannabis sativa*, the drug type and the fiber type. In addition to this classical distinction of these two groups, botanists

generally accept description consisting of three chemical types: (a) the pure drug type, high THC content (2-6 percent) and lacking CBD[cannabidiol]; (b) the "intermediate type" (predominantly THC); and (c) the fiber type (THC<0.25 percent)." [16]

Dr. Mahmoud ElSohly, Director of the National Institute on Drug Abuse Marijuana Project at the University of Mississippi-Oxford, which analyzes *Cannabis* samples sent in by law enforcement agencies, explained to the author [17] that his group is currently reevaluating the data collected since the 1960s. They are taking a new approach that classifies any sample with less than 1.0 percent THC and a CBD-to-THC ratio greater than one as "ditchweed," in order to have a proper discrimination among the samples. This was never done for the data on which the claims of great potency increase are based, from pre-1983 samples. Interestingly, this same threshold-

THC less than 1 percent and the ratio of CBD to THC greater than one

-is a prescription for industrial hemp.

Current hemp varieties grown in Canada and Europe are certified to have THC levels below 0.3 percent. The certification system originally developed in Europe to allow for the commercialization of industrial hemp considered the ratio of CBD to THC as well as the absolute percent THC. The original THC threshold was 0.8 percent. When varieties with lower levels of THC were developed by French breeders, the breeders were able to persuade the European Union to reduce the tolerance further, giving the French until recently a *de facto* monopoly of hemp seed varieties sold in the European Union.

In the United States, *Cannabis* with any detectable trace of THC is illegal. CBD is not considered at all.

Exposing the Myths

Much of the rest of the world quickly and relatively easily moved beyond the debate about hemp and marijuana to focus on how best to reintroduce a crop that at one time was the world's best selling fiber. In the United States we are still paralyzed by our belief that industrial hemp is a drug crop. This belief has been nurtured by the dissemination of much misinformation. Here we shall shed some scientific light on ten of the most widespread and dark myths about the relationship of marijuana and hemp.

Myth: U.S. law has always treated hemp and marijuana the same

Reality: U.S. drug laws offer clear evidence that the U.S. government at one time understood and accepted the distinction between marijuana and hemp.

The 1937 Marijuana Tax Act defined marijuana as: "(A)ll parts of the plant *Cannabis sativa* L., whether growing or not; the seeds thereof; the resin extracted from any such plant; and every compound, manufacture, salt, derivative, mixture, or preparation of such plant, its seeds, or resin; but shall not include the mature stalks of such plant, fiber produced from such stalks, oil or cake made from the seeds of such plant, any other compound, manufacture salt, derivative, mixture, or preparation of such mature stalks (except the resin extracted therefrom), fiber, oil, or cake, or the sterilized seed of such plant which is incapable of germination." [18]

The Marihuana Tax Act was proposed by the Treasury Department, a division of which was the Bureau of Narcotics. In support of the bill, Assistant General Council Clinton Hester testified: "The form of the bill is such . . . as not to interfere materially with any industrial, medical or scientific uses which the plant may have. Since hemp fiber and articles manufactured therefrom are obtained from the harmless mature stalk of the plant, all such products have been completely eliminated from the

purview of the bill by defining the term "marijuana" in the bill, so as to exclude from its provisions the mature stalk and its compounds or manufacturers."

Hester went on to add: "There are also some dealings in marihuana seeds for planting purposes and for use in the manufacture of oil which is ultimately employed by the paint and varnish industry. As the seeds, unlike the mature stalk, contain the drug [later shown to be untrue-dpw], the same complete exemption could not be applied in this instance. But this type of transaction, as well as any transfer of completed paint or varnish products, has been exempted from transfer tax." [19]

Harry J. Anslinger, Commissioner of the Federal Bureau of Narcotics (the predecessor to the Drug Enforcement Administration (DEA)), told the Senate Committee that those in the domestic hemp industry "are not only amply protected under this act, but they can go ahead and raise hemp just as they have always done it."

After the passage of the Marihuana Tax Act, during World War II, the federal government launched an aggressive "Hemp for Victory" campaign. U.S. armed forces had relied on abacá, Manila hemp, imported from the Philippines, for rope, canvas, uniforms, and other products. After the Philippines fell to Japanese forces in 1942, the Department of Agriculture and the U.S. Army urged farmers to grow hemp. Without any change in federal law, more than 400,000 acres of hemp were cultivated in the United States between 1942 and 1945, aided by the War Hemp Industries Corporation, which built 42 hemp mills in the Midwest [20]. The last commercial hemp fields were planted in Wisconsin in 1957.

In 1961 the U.S. became a party to the United Nations Single Convention on Narcotic Drugs [21]. That Convention expressly recognized the distinction between marijuana and industrial hemp, exempting the latter from coverage. "This Convention shall not apply to the cultivation of the *Cannabis* plant exclusively for industrial purposes (fiber and seed) or horticultural purposes." [22]

The United Nations Convention Against Illicit Traffic in Narcotic Drugs and Psychotropic Substances (1990, supplement to the UN Single Convention on Narcotic Drugs) did not concern itself with such botanical aspects of the *Cannabis* plant as THC [23]. The terms of this treaty concerned the use to which the plant is put. As such, this treaty does not constrain its signatories' freedom to allow industrial hemp agriculture. Canada, Australia, the United Kingdom, Germany, Austria-all countries with expanding hemp acreage-are signatories to this convention.

In 1970, the Comprehensive Drug Abuse Prevention and Control Act repealed the Marihuana Tax Act but incorporated verbatim that Act's definition of "marihuana."

"The term 'marihuana' means all parts of the plant *Cannabis sativa* (L.), whether growing or not, the seeds thereof, the resin extracted from any part of such plant; and every compound, manufacture, salt, derivative, mixture, or preparation of such plant, its seeds or resin; . . ." [24]

The key difference was that, while the 1937 Act used a system of taxation and disclosure that allowed the government to penalize marijuana growers without punishing industrial hemp growers, the 1970 Act abolished the taxation approach and effectively made all *Cannabis* cultivation illegal, except where the DEA issued a limited-use permit, by setting zero tolerance for THC.

There is no indication that, in the debate about the 1970 law, the implications of its passage on the future of industrial hemp were ever considered. By that time the domestic industrial hemp industry had disappeared, and there were no farmers to argue its case.

Despite the 1970 narcotics act, which resulted in the lumping together of marijuana and hemp, the federal government continues to make a distinction between the two plants. For example, in 1994, by Executive Order, the President of the United States designated hemp as a strategic crop of importance to national security [25].

Hemp is legally grown by 29 countries around the world at present, with almost half of these having made hemp cultivation legal only in the last few years. In 1996 world hemp production was about 100,000 metric tons. Four-fifths of this total was grown in China, Russia, and Korea [26]. Each year the U.S. government identifies those countries that it considers to be drug-exporting nations. None of the major hemp-growing and -exporting nations has ever been listed.

The legal history is clear. The federal government has long recognized the distinction between hemp and marijuana. This distinction is codified in numerous domestic laws and statutes and in international treaties to which we are a party. The DEA has it in its authority to recognize this history and to drop hemp from its narcotics schedule. Instead the DEA, unlike its predecessor, the Bureau of Narcotics, is aggressively trying to persuade Americans that hemp and marijuana are identical plants. We can speculate about the reasons. The results are widespread confusion and the inability of America's farmers and manufacturers to take part in the worldwide resurgence of hemp cultivation and use.

Myth: Smoking industrial hemp can get someone high. Marijuana in the 1960s contained THC levels approaching those of today's hemp.

Reality: The THC levels in industrial hemp are so low that no one can get high from smoking it. Moreover, industrial hemp, while low in THC, is high in another kind of cannabinoid, CBD, which counteracts THC's psychoactivity.

As William M. Pierce Jr., Ph.D., Associate Professor of Pharmacology and Toxicology at the University of Louisville School of Medicine notes, "Industrial hemp does in fact contain a psychoactive substance, tetrahydrocannabinol (THC) and thus the question appears at first reading to be a reasonable one. Upon closer consideration, however, using the most fundamental principles of pharmacology, it can be shown that it is absurd, in practical terms, to consider industrial hemp useful as a drug." [27]

According to Professor Pierce, to obtain a psychoactive effect with even 1 percent THC hemp (industrial hemp and feral hemp, the wild hemp the DEA aggressively harvests and burns [28], contain less than 0.5% percent THC [29]), would require the user to smoke 10-12 cigarettes containing hemp in a "very short period of time. . . . This large volume (and) high temperature inhalation of vapor, gas, and smoke would be difficult for a person to withstand, much less enjoy." Professor Pierce goes on to note that anyone who ate hemp hoping to get "high" would be consuming the fiber equivalent of several doses of a high-fiber laxative. In other words, the very unpleasant side effects would dissuade anyone from trying to use industrial hemp as a drug.

Dr. Pierce points out that beer sold as "nonalcohol" contains measurable alcohol. So does mouthwash. Even nutmeg contains a psychoactive substance. But the authorities are not aggressively concerned about the abuse of these products because the side effects are so severe as to discourage such abuse.

Critics have alleged that the marijuana of the sixties had THC levels comparable to those of industrial hemp. But when Lynn Zimmer, Ph.D., and John Morgan, M.D., examined this assertion they found it lacked substance.

When today's youth use marijuana, they are using the same drug used by youth in the 1960s and 1970s. A small number of low-THC samples seized by the Drug Enforcement Administration in the early 1970s are used to calculate a dramatic increase in potency. However, these samples were not representative of the marijuana generally available to users during this era. Potency data from the early 1980s to the present are more reliable, and they show no increase in the average THC content of marijuana. [30]

Dr. Mahmoud ElSohly, Director of the Marijuana Project at the University of Mississippi-Oxford for the National Institute on Drug Abuse, was asked by the author about his assertion, quoted in antihemp

literature [31], that 0.5 percent THC could produce a high. Dr. ElSohly admitted that it might be difficult to distinguish from a placebo effect and would require a substantial amount of smoked material. He acknowledged that the CBD in industrial hemp confounds the psychoactive effect of the THC and called for more research in this area.

When industrial hemp is grown legally and where federal authorities do not call it marijuana, people do not smoke it. Industrial hemp is a crop that no informed person would smoke, and if the naive do, they do not remain naive. If they think they got "high," they are confusing the experience with anoxia or hyperventilation.

Myth: Even though THC levels are low in hemp, the THC can be extracted and concentrated to make a powerful drug.

Reality: Extracting THC from industrial hemp would require such an expensive, hazardous, and time-consuming process that it is extremely unlikely anyone would ever attempt it, rather than simply obtaining high-THC marijuana instead.

Botanist and *Cannabis* expert Robert C. Clarke, writing for the International Hemp Association to Health Canada concerning Canada's new regulations, addressed this issue as follows: "Although industrial hemp does contain trace amounts of THC, it is of no practical significance. There is also a minor percentage of precious gold dissolved in sea water, but it is no more economically feasible to extract than is THC from hemp." [32]

If industrial hemp were "cooked down" to concentrate the extract, it would also, as noted by Dr. Paul Mahlberg, Professor of Biology at Indiana University-Bloomington, contain many products other than THC, including CBD, which would counteract the effects of the THC.

Dr. Mahlberg, is one of the U.S. scientists with permission to work with *Cannabis*.. When asked by the Wisconsin Agribusiness Council about reports that someone had used feral hemp, commonly called ditchweed, to make a concentrated hallucinogen, he responded: "As I understand it, the comment was that someone had used ditchweed to prepare hallucinogenic material. The assumed conclusion drawn by some people then being that industrial hemp could be used in this way. My response to this conclusion is that industrial hemp will not be attractive to drug users. Industrial hemp, as grown in Europe, contains 0.3 percent or less THC, and is not a source of marihuana; marihuana attractive to drug users contains 5 to 20 percent THC, the higher percent being the desired material." [33]

Dr. Mahlberg went on to point out that an extraction from industrial hemp using a deceptive procedure found on the Internet will result in a sludge containing many noxious elements and very little THC. Of course the preponderant cannabinoid in this sludge will be CBD. The THC would have to be further refined from the CBD, an expensive and complicated undertaking for a paltry yield. Furthermore, Dr. Mahlberg explains, the chemicals required to attempt such an extraction are themselves restricted. Any individuals attempting this would be conspicuous and a danger only to themselves.

A number of untrue or undocumented statements have been made by the drug enforcement network regarding feral hemp and its relationship to drugs. For example, several state and local police officers have publicly testified that they know of instances in which ditchweed has been made into high-potency drugs. Yet we can find no documented case where this has occurred. [34]

A drug officer in one Wisconsin county wrote the following to the Wisconsin Agribusiness Council to discourage them from supporting industrial hemp: "Dr. Guy Gabral (sic, actually Cabral), University of Virginia, has documented the use of "drug chaw," a cancer-causing product made from 0.1 percent THC marijuana that through chemical process becomes a product containing 40 percent THC." [35] When contacted about this quote, Dr. Cabral repudiated it. He explained that he was describing an

Afghani method of hashish production that employs potent *Cannabis* strains and not something that could be done with industrial hemp. [36]

Myth: Hemp fields would be used to hide marijuana plants.

Reality: Hemp is grown quite differently from marijuana. Moreover, it is harvested at a different time than marijuana. Finally, cross-pollination between hemp and marijuana plants would significantly reduce the potency of the marijuana plants.

Hemp grown for fiber is planted in narrow row spacing (4 inches apart). Branching is discouraged, and plants are not allowed to flower. The stems are kept small by the high density and foliage develops only on the top. Hemp plants crowd out weeds and other hemp plants not equal to the competition. [37]

Marijuana plants, on the contrary, are spaced widely to encourage branching, and the flower is the harvested product. Marijuana is a horticultural crop planted in wide spacing to minimize stand competition and promote flower production. It branches thickly like a Christmas tree. In contrast, hemp selected for fiber has only a few branches.

What about seed producers who space their plants widely? Where seed is the harvested product, whether as reproduction seed or oilseed, purity is critical to marketability. The mixing of off-type genotypes would be scrupulously avoided in seed production fields.

Breeders and producers of sweet corn go to great lengths to isolate their crops from the pollen of field corn. The same applies to hemp and marijuana. People who grow strains of *Cannabis* for smoking try to avoid pollination of the flowers. The superior quality material is obtained from seedless plants, the so-called "sinsemilla."

Hemp fields, in fact, could be a deterrent to marijuana growers. A strong case can be made that the best way to reduce the THC level of marijuana grown outdoors would be to grow industrial hemp near it. An experiment in Russia found that hemp pollen could travel 12 kilometers. This would mean that a hemp field would create a zone with a 12-kilometer radius within which no marijuana grower would want to establish a crop.

The reciprocal also applies. Growers of hemp seed would not want *Cannabis* of an "off type" (i.e., not the intended genetic type) mixing its pollen with their flowers. The isolation of genotypes is a common procedure used by the seed industry to preserve the genetic integrity of varieties. Valued strains are created by plant breeding, at substantial expense. Marijuana pollen would destroy this value.

There is another reason that marijuana growers would be unlikely to plant their crop in a hemp field. All countries that have recently begun to recommercialize hemp operate under a permit system whereby the farmer must let the local police know which field is being planted in hemp. Would a marijuana grower decide to plant his or her crop in an area high on the police radar screen and subject to monitoring without notice?

Ironically, another fiber crop, kenaf, grown in the South, resembles *Cannabis* in its leaf morphology so closely that it is often mistaken for marijuana. Growers report frequent incidents of kids stealing kenaf that they have taken for marijuana. Since kenaf would not cross-pollinate with *Cannabis*, and has a longer growing season, kenaf fields would actually be a better hiding place for marijuana than would hemp fields.

Myth: Legalizing hemp while continuing the prohibition on marijuana would burden local police forces.

Reality: The police in countries where hemp is grown as an agricultural crop have experienced no such burdens.

The key to a regulated hemp industry is seed certification, a common practice in the international seed industry. The burden for producing hemp varieties compliant with the prescribed THC threshold falls on the seed producer and breeding operation. As mentioned, THC content is genetically determined. Numerous low-THC varieties have been produced by European hemp breeders and these are certified by the appropriate government agency that publishes the approved list. (The protocol used in Europe to determine the average THC content of a given variety is appended to this document.)

Hawaii State Representative Cynthia Thielen reported from her investigative trip to Europe that the police forces in these countries have observed no problems with the agricultural production of industrial hemp. [38]

In countries that have recently legalized industrial hemp, individual farmers and manufacturers are licensed and registered. Field locations are recorded with local authorities. Only when there is probable cause does law enforcement need to concern itself with individual farmers.

Canadian authorities have recently issued final regulations that will allow for the first commercial hemp crop in that country in more than 50 years (A summary is appended to this document. These regulations are a workable compromise between farmers who want to minimize paperwork and regulatory delays and police authorities who want to prevent the growing of marijuana. Health Canada concludes: "This recommended regulatory framework provides the criteria to assess the suitability of an applicant to conduct a licensed activity." [39]

In contrast, the current regulations in the United States require that all live hemp seed be stored in a locked safe, and that fields be surrounded with 10-foot-high, barbed-wire-topped fencing, illuminated 24 hours a day, and guarded [40]. And even with these draconian regulations, no permit to grow hemp has been issued by the DEA.

Myth: Feral hemp must be eradicated because it can be sold as marijuana.

Reality: Feral hemp, or ditchweed, is a remnant of the hemp once grown by U.S. farmers. A study of feral hemp in Kansas showed that it contains extremely low levels of THC, from 0.5 percent to as low as 0.05 percent and less [41]. It has no drug value, but it does offer an important environmental benefit as a desirable nesting habitat for birds. Yet 99 percent of the "marijuana" being eradicated by the federal government-at great public expense-consists of this harmless ditchweed.

We have no way of knowing whether feral hemp has been sold as marijuana. What we do know is that if this were done, it would be to fatten the profits of the drug dealer, not to increase his supply of drugs. Feral hemp, like oregano, parsley, and kenaf, has been used to dilute marijuana and defraud drug customers. That is no reason to outlaw hemp nor to burn down oregano and parsley patches. We don't make sugar illegal because it is used to cut cocaine.

That kids may try smoking hemp or ditchweed is to be expected. Many farmers remember smoking cornsilk when they were young. Moreover, young people have seen the National Guard swooping down from helicopters to burn feral hemp. They have then read that the plants burned were marijuana. One would expect that, based on this misinformation, they would experiment with feral hemp.

Where hemp is grown as a common agricultural crop, it is not bothered once the introductory period is over and the inquisitive have learned their lesson [42]. Where hemp is legal and marijuana is illegal, hemp does not suffer from misidentification or attempted misuse. This is true today in other countries, as it was once true in our own nation.

In Britain, the Drugs Branch reports that since hemp cultivation began in 1993, "there have been very few thefts of crop and diversion from licit sources has been insignificant." [43] According to Ian Low, founder of Hemcore, Ltd., and by far the largest cultivator of hemp in the United Kingdom, Hemcore has had only one incident of someone stealing hemp. That occurred in the company's first year, and it has not happened since. [44]

When hemp was legally grown in the United States, there were few if any examples of its being used for illicit purposes. In 1945, Matt Rens of the Rens Hemp Company of Wisconsin told a Senate hearing, "In the 30 years we have operated and grown large acreages we have never heard of one instance where there was an illicit use made of the leaves of this hemp plant. . . . We have never heard of anybody trying to get into the field and take the leaves for illicit purposes." Samuel H. McCrory, a senior United States Department of Agriculture official, told the Senate committee that he knew of no cases in which anyone had tried to divert industrial hemp leaves or flowers from federal or private hemp mills.

The evidence shows that there are no good reasons for authorities to be eradicating ditchweed, while there are at least two good reasons for them not to do so. The ditchweed that these agencies are pulling up represents the only germplasm remaining from the hemp bred over decades in this country to achieve high yields and other important performance characteristics. This breeding was done by the United States Department of Agriculture in a program directed by Dr. Lyster Dewey from 1912 to 1933. These plants represent a unique and invaluable genetic resource that should be preserved.

Another reason to reconsider our efforts to eradicate feral hemp is that, as Joel Vance writes in *Outdoor Life* magazine, "Conservationists who are against the use of marijuana by people nevertheless find themselves in the weed's corner because of its use by wildlife." [45] Hemp plays a role in supporting gamebird populations in Missouri and Nebraska. According to Dr. Bob Robinson, who experimented with hemp at the University of Minnesota in the 1960s, hemp was good for wildlife because its seed was held just above the snowline. The National Wildlife Federation has determined that, of 28 native bird species studied from 1966-1995, half are in decline, including Henslow's sparrow (down 93 percent), the bobolink (down 37 percent), and the Eastern meadowlark (down 53 percent). Yet feral hemp, which contains the wildbird food seed of choice, a seed that is sold (imported and sterilized) in pet stores as high-priced parrot feed, is branded a drug plant and a noxious weed.

One may wonder why, given the uselessness of feral hemp as a drug and its important benefits, drug enforcement authorities are spending so much money to eradicate it. We hesitate to ascribe motives for this waste of taxpayer money, but it is likely that drug authorities continue to miseducate the public about the relationship of ditchweed to drugs because of a natural bureaucratic desire to maintain their large and growing eradication budgets. More than 90 percent of the plants eradicated in all 50 states is not marijuana but feral hemp. The following is the data for one representative state, Wisconsin, and a summary from the DEA of the most recent national data. As the data shows, hundreds of millions of dollars a year are spent pulling up a harmless, even beneficial plant with no drug potential.

Wisconsin Data from *Cannabis Enforcement and Suppression Effort, Annual Report 1996*

Wisconsin State Dept. of Justice, Division of Narcotics Enforcement

	1991	1992	1993	1994	1995	1996
Total Plants Eradicated	6,042,407	35,873,893	13,850,955	3,059,450	5,030,651	9,564,557
Ditchweed	5,964,331	35,853,407	13,807,729	3,045,282	4,975,441	9,551,143
Percent ditchweed	98.7%	99.9%	99.7%	99.5%	98.9%	99.9%

National Data Summary from *The Domestic Cannabis Eradication/Suppression Program,*

U. S. Dept. of Justice, Drug Enforcement Admin.

	1990	1991	1992
Total Plants Eradicated	**125,876,752**	**139,326453**	**272,046,333**
Ditchweed	**118,547,983**	**133,786,059**	**264,206,672**
Percent ditchweed	**94%**	**96%**	**97%**

Myth: Those who want to legalize hemp are using it as a backdoor way to legalize marijuana.

Reality: It is true that many of the first hemp stores were started by industrial-hemp advocates who also favored legalizing marijuana. However, as the hemp industry has matured, it has come to be dominated by those who see hemp as the agricultural and industrial crop that it is, and who see it as a different issue than marijuana legalization. In any case, it makes no sense to oppose a very good idea simply because some of those who propose it also support another policy with which one disagrees.

Given that the federal authorities consistently call hemp marijuana, treat both materials in the same way, and have outlawed both, an overlap between those who promote the legalization of both is to be expected. But to outlaw an innocent plant because some people in favor of legalizing it are also in favor of legalizing another less innocent plant is unreasonable.

The fact that there is an overlap between those who favor less stringent penalties for possession of marijuana and those who want to legalize hemp is less a justification for continuing to outlaw hemp than it is a justification for ending the 60 year old policy of the federal government of confusing these functionally distinct plants.

The debate about legalizing hemp has been distorted by the fact that, in this country, hemp legalization is under the jurisdiction of the drug enforcement agencies. In other countries, jurisdiction falls to the health agencies, and agricultural agencies have had a significant role in the movement to commercialize hemp. In Canada, for example, Health Canada gave the initial permission to raise hemp for research purposes and as soon as questions arose from farmers and the general public about this crop, Canada's agricultural department issued a substantive bulletin containing agronomic and economic data [46].

Myth: Hemp oil is a source of THC.

Reality: Washed hempseed contains no THC at all. The tiny amounts of THC in industrial hemp is contained in the glands of the plant itself, and sometimes in the manufacturing process some of that sticks to the seed. The very high sensitivity of drug-testing urinalysis procedures has detected THC in some people who consume hemp oils [47]. But this is no more a reason to outlaw hemp oil than is the fact that people can test positive for opioids after eating bagels or poppyseed cake a reason to outlaw these kinds of foods.

Hemp oil is an increasingly popular product, used for a growing variety of purposes. To allow for its sale while respecting the potential problems of positive drug test results, Canada recently issued drug regulations with a tolerance level of 10 milligrams of THC per kilogram of hemp oil [48]. While the hemp industry opposes the imposition of tolerance limits, it is confident that it can consistently produce high-quality hemp oil with THC levels below the Canadian maximum.

Myth: Legalizing hemp would send the wrong message to children.

Reality: It is the current refusal of the drug enforcement agencies to distinguish between an agricultural crop and a drug crop that is sending the wrong message to children.

When young people realize that the government has been misinforming them about the psychoactive potential of industrial hemp, they may assume that the government is also misinforming them about the addictive potential of real drugs. When they discover that many of our Founding Fathers, such as George Washington, Thomas Jefferson, and Benjamin Franklin, grew or processed hemp, and that hemp was grown as part of a patriotic war effort during World War II, they will begin to wonder what else they may not have been told about hemp. This could have the unfortunate effect of causing them to wonder if the government has also been "crying wolf" about real drugs. By condemning teachers who try to educate their students about industrial hemp, as has occurred in several parts of the country, drug enforcement agencies are undermining their credibility with these youngsters when they try to teach them about the real dangers of crack cocaine.

Myth: Hemp is not economically viable, and should therefore be outlawed.

Reality: The market for hemp products is growing rapidly. But even if it were not, when has a crop ever been outlawed simply because it was thought to be unprofitable to raise?

Retired General Barry McCaffrey of the White House Office of National Drug Control Policy has said that one of the reasons that he continues to support the criminalization of hemp cultivation is because hemp is not an economical crop. It is an odd argument. There is no record in U.S. history of a crop being outlawed because it was uneconomical. Moreover, General McCaffrey has made no indication that he would allow hemp to be grown even if he were persuaded that it could dramatically boost farmers' income.

The USDA has aggressively supported the introduction of many crops in the last 20 years that, when initially supported, were marginally economical and had small potential markets (e.g., jojoba, meadowfoam, kenaf). The Department rightly argued that, with breeding and the introduction of more effective cultivation and storage technologies, these crops could indeed be profitable for farmers.

Hemp is a multipurpose crop. New markets for its oils, protein, long fibers, and inner hurds are constantly opening up. Hemp production is increasing worldwide, as are hemp sales. Innovations in processing and in cultivation promise to lower costs and open up still more markets. The production increase is most dramatic in Europe, where hemp, like other crops such as rapeseed and flax, is subsidized. Hemp commercialization has begun in Canada, where as many as 10,000 acres could be planted in 1998, even though our northern neighbors receive no government incentives to grow the crop.

Preliminary evidence also indicates that hemp may be a very significant rotation crop with an ability to reduce pests and weed growth and to boost yields of the primary crop.

The North American Industrial Hemp Council soon will publish an in-depth report on hemp's economics and markets. Here we would only argue that in a free enterprise system, government should not and cannot make the *a priori* decision to outlaw a crop simply because it believes farmers would lose money by growing it.

Conclusion

Hemp is making a comeback around the world. Whether it will be a miracle crop, as some of its enthusiasts claim, or simply another important addition to world agriculture, is yet unknown. Much research and development remains to be done. Sadly, the drug enforcement agencies, by disseminating false information, have created a mythology about *Cannabis sativa* that ill serves the nation, its farmers, and its industry.

We are one of the few countries in the world that continues to insist that we should outlaw a crop simply because one of its botanical cousins can be used inappropriately. Thomas Jefferson, who experimented with different hemp varieties and invented a brake for separating out the fiber from

hemp, once wrote that the greatest contribution a person could make to his country would be to introduce a new crop. If Jefferson could see the roadblocks amassed against hemp today, how would he judge us?

Appendix

COMMERCIAL PRODUCTION OF INDUSTRIAL HEMP IN CANADA

Industrial hemp can now be grown in Canada effective March 12 , 1998, under authorization from Health Canada.

Industrial Hemp is defined as the plants and plant parts of the *Cannabis* plant, whose leaves and flowering heads do not contain more than 0.3 percent THC. It includes derivatives of the seeds such as oil and seedcake. It does not include non-viable *Cannabis* seed, but it includes its derivatives. It also does not include the mature stalks or the fibres derived from those stalks. This means that such fibres or the products made from the mature cannabis stalk may be imported, treated and sold in Canada.

The Regulations issue by Health Canada consist of the following components:

_Importers and exporters of industrial hemp, in the form of seed or viable grain, will be licensed. In addition to holding a licence they will also be required to obtain a permit for each shipment.

_The importer must ensure that shipments of live seed ("viable grain") are accompanied by foreign certification. A list will be published by Health Canada indicating which countries are designated as having equivalent controls on the production of viable grain. Viable grain may only be imported from listed countries. This will ensure that viable grain imported will not produce a plant containing more than 0.3% THC.

_Seed growers will be restricted to a 0.4 hectare (1.0 acre) minimum plot size and will be required to demonstrate current membership in the Canadian Seed Growers Association as part of their licence application. Seed growers will be required to provide the number of hectares grown in the previous two years as part of their licence application.

_Plant breeders will not be restricted to minimum plot sizes. Persons applying for a licence as a plant breeder must be registered with the Canadian Seed Growers Association and may only cultivate industrial hemp under this regulatory framework. The pedigreed seed restriction (i.e., seed of proven lineage) which applies to growers in the year 2000 does not apply to plant breeders nor does the limitation to the List of Approved Cultivars. (Breeders can employ a broader selection of germplasm in their effort to develop new cultivars for Canadian growing conditions.)

_Growers for fibre or viable grain will require a licence before they can purchase seeds from a distributor or cultivate industrial hemp. Growers will be required to provide the number of hectares grown in the previous two years as part of their licence application.

_Only approved varieties of industrial hemp seeds, as listed on Health Canada's List of Approved Cultivars may be planted. Commencing January 1, 2000, only pedigreed seeds of approved varieties may be planted. Growers will be required to identify their fields, and maintain records of production and distribution.

_Licences and audit trails will also be required for processing activities such as pressing seeds into oil. All parties licensed or authorized will be required to identify a person resident in Canada who will be responsible for the licensed activities.

_To obtain a licence for the importation, exportation, production or sale of industrial hemp, applicants will be required to produce a police security check issued by a Canadian police force setting out for the previous 10 years the applicant's criminal record in respect of any designated drug offences, or indicating that the person has no such record.

_Derivatives of seed or viable grain, such as oil and seed cake, will be exempted from the Regulations if there is evidence that the derivatives contain no more than 10 micrograms of delta-9-tetrahydrocannabinol per gram and carry appropriate labelling statements. Products made from derivatives of seed or viable grain will be exempted if there is evidence that each lot or batch contains no more than 10 micrograms of delta-9-tetrahydrocannabinol per gram.

_Importers and exporters of derivatives will be required to provide proof with each shipment that the shipment contains no more than 10 micrograms of delta-9-tetrahydrocannabinol per gram for each lot to ensure that the product is within the

limit. Similarly products made from the derivatives of seed or viable grain must be accompanied with evidence that each shipment contains no more than 10 micrograms of delta-9-tetrahydrocannabinol per gram.

_No person will be permitted to import or sell whole plants, including sprouts or the leaves, flowers or bracts of industrial hemp; or import, sell, or produce any derivative or any product made from a derivative of the above.

_Authorizations will be required for transportation, when products are transported outside the direction or control of a licence holder, or for possession for the purpose of testing for viability.

_No person shall advertise to imply that a derivative or product is psychoactive.

_Testing for the level of THC in leaves or in derivatives must be done by a competent laboratory according to standards defined by Health Canada.

_Health Canada will continue to issue licenses for approved research studies related to the cultivation of hemp for industrial purposes.

_Application Forms and relevant Guidance Documents, aimed at expediting the review of licences and authorizations for the commercial cultivation of industrial hemp and also for research licences, are available.

Additional information can be found at:

Internet: http://www.hc-sc.gc.ca/hpb-dgps/therapeut/drhtmeng/hemp.html

or Jean Peart, Manager, Hemp Project

Bureau of Drug Surveillance

Therapeutic Products Directorate

Address Locator 4103A, 122 Bank Street, 3rd Floor

Ottawa, Ontario, Canada, K1A 1B9

Phone: (613) 954-6524 FAX: (613) 952-7738

Internet: jean_peart@hc-sc.gc.ca

Copies of the Controlled Drugs and Substances Act are available from:

Internet: canada.justice.gc.ca/FTP/EN/Laws/

or Canada Communications Group

Ottawa, Ontario

K1A 0S9

Telephone - (613) 956-4802

Appendix

Official Journal of the European Communities

ISSN 0378-6978

L 121

Vol. 32

29 April 1989

ANNEX C

COMMUNITY METHOD FOR THE QUANTITATIVE DETERMINATION OF DELTA-9 THC (TETRAHYDROCANNABINOL) IN CERTAIN VARIETIES OF HEMP

1. Purpose and scope

This method permits quantitative determination of delta-9 tetrahydrocannabinol (delta-9 THC) in certain varieties of hemp *Cannabis sativa* L.) for the purpose of checking that the conditions laid down in Article 3 (1) of Regulation (EEC) No. 619/71 are fulfilled.

2. Principle

Quantitative determination of delta-9 THC by gas chromatography (GC) after extraction with a suitable solvent.

3. Apparatus.

- gas chromatography equipment with a flame ionization detector,

-glass column 2,50 m long and 3,2 mm in diameter (1,8") packed with a suitable support impregnated with a stationary phase phenyl-methyl-silicon (e.g. OV 17 at 3 %).

4. Sampling and reduction of sample

Sampling

In a standing crop of a given variety of hemp, take not less than 500 plants, preferably at different points but not from the edges of the crop. Samples should be taken during the day after flowering has finished.

The pooled samples should be representative of the lot.

The plant material is then left to dry at ambient air temperature.

Reduction

Reduce the sample, obtained as described, to 500 stalks; the reduced sample should be representative of the original sample. Divide the reduced sample into two portions.

Send one portion to the laboratory which is to determine the delta-9 THC content. Keep the other portion for counter-analysis if necessary.

5. Reagents

- petroleum ether (40)/65°), or a solvent of comparable polarity,

- tetrahydrocannabinol (delta-9 THC), pure for chromatographic purposes,

- solution of 0,1% (w/v) androstene-3-17-dione in ethanol, pure for

chromatographic purposes.

6. Preparation of test sample

For the purposes of delta-9 THC determination, retain the upper third of the plants in the portion of sample received. Stems and seeds must be removed from the plant material retained.

Dry the material in an oven, without exceeding 40°C, to obtain a constant weight.

7. Extraction

Reduce the material obtained as described in point 6 to a semi-fine powder (sieve of 1000 meshes per cm^2.

Take 2,0 g of well-mixed powder and extract with 30-40 ml petroleum ether (40-65°C). Leave for 24 hours, then shake in a mechanical shaker for one hour, and then filter. The extraction process is carried out twice under the

same conditions. Evaporate the petroleum ether solutions to dryness. Dissolve the residue in 10.0 ml of petroleum ether. The prepared extract is used for quantitative analysis by gas chromatography.

8. Quantitative analysis by gas chromatography

(a) Preparation of assay solutions

The extraction residue dissolved in 10.0 ml of petroleum ether is subjected to quantitative analysis to determine the delta-9 THC content. This is performed with the aid of an internal standard and calculation of the peak areas.

Evaporate to dryness 1,0 ml of the petroleum ether solution. Dissolve the residue in 2,0 ml of a solution of 0,1% androstene-3-17-dione in ethanol (internal standard with a retention time distinctly higher than that of other cannabinoids, and in particular twice that of delta-9 THC).

calibration ranges:

0,10, 0.25, 0,50, 1,0 and I,5 mg of delta-9 THC in 1 ml of a

solution of 0,1% androstene-3-17-dione in ethanol.

(b) Experimental conditions

Oven temperature: 240°C.

Injector temperature: 280°C.

Detector temperature: 270°C.

Nitrogen flow rate: 25 ml/min,

Hydrogen flow rate: 25 ml/min,

Air flow rate: 300 ml/min,

Volume injected: 1 ml of the final ethanol solution.

The relative retention time of delta-9 THC is calculated in relation to the andostene.

9. Expression of the results

The result is expressed in g of delta-9 THC per 100 g of the laboratory sample dried to constant weight. The result is subject to a tolerance of 0,03g per 100g.

Author's Acknowledgments

I would like to thank those who have assisted in the preparation of this document. First and foremost, I want to recognize David Morris, Ph.D., of the Institute for Local Self Reliance, Minneapolis, Minnesota, for his tireless assistance in editing and critiquing this project and guiding it to fruition. It has been an honor and a privilege to work with him. Although any errors in the document are my responsibility, much of the credit for the scope and flow of the document go to Dr. Morris.

I also wish to recognize the panel of reviewers for their attention to the details. Professor Paul Mahlberg, Ph.D., Indiana University-Bloomington, provided valuable tutelage assisting my

understanding of the current state of *Cannabis* biochemistry. Ernest Small, Ph.D., Health Canada, helped sort out the confusing taxonomy of the genus. Richard Musty, Ph.D., University of Vermont, brought to my attention the critical works on the anti-THC effect of CBD. And Steven A. Thompson, Ph.D., of Dow AgroSciences, Indianapolis, Indiana, reviewed and critiqued the original manuscript in detail from a plant breeder's perspective.

I would also like to thank the North American Industrial Hemp Council for commissioning this work, and those members of the organization who provided valuable feedback as the document evolved, specifically, Andy Kerr ("Mr. Spotted-Owl") of The Larch Co., Joseph, Oregon; and John Roulac of Hemptech, Inc., Sebastopol, California.

David P. West, Ph.D.

Prescott, Wisconsin

February 27, 1998

Return to Hemp Reports

Comments and proposal for Industrial Hemp in Wisconsin: Carl Duley, Buffalo County UW-Extension Agricultural Agent, Alma, WI 608-685-6256. carl.duley@ces.uwex.edu In cooperation with Buffalo County Farm Bureau.

Why Industrial Hemp in Buffalo County?

- Have a history of successful cultivation of industrial hemp until following WWII when fibers made from petroleum became cheap in the market place.
- Buffalo County farmers are looking for diversification in crop production with crops that grow densely and limit erosion potential.
- Industrial hemp is planted mid to late May and is harvested early enough to establish cover crops in Buffalo County (harvested by mid-September).
- Buffalo County silt-loam soils are well suited to industrial hemp production.

Study needed?

- Variety and planting date.
- Pest control especially weed control. There are no registered pesticides for industrial hemp at this time.
- Yield data of seed and fiber. Need to determine if we can complete with other regions that have been studying and producing industrial hemp already.
- Uses best suited to Western Wisconsin:

Seeds	Log Fiber (bark)	Woody Stem Core	Female floral bract	Whole Plant
Salad oil	Molded plastic products	Animal bedding	Essential oils	Fuel
Animal food	Specialty papers	Insulation	Insect repellant	Silage
Confectionary	Construction fiber	Construction fiber	Medicine	Alcohol
Industrial oil	Course Textiles			
Cosmetics	Fine textiles			

Why Buffalo County to study in 2018 (or as early as possible)

- Tradition – industrial hemp grown in Buffalo County, delivered to Winona, MN, and processed there. Still found growing wild in the areas that had hemp bases in the 1950's.
- We have the equipment to conduct trials; plot planter, plot combine, plot forage harvester, and plot research experience.
- We have a small oil pressed used in a farm scale bio-diesel project that can be used to measure oil yield per acre of hemp production.
- We have willing farmers that are looking to diversify the agricultural landscape in Buffalo County. They are willing to provide small acres of land for research/local trials.
    - No-till started in early 1980's
    - Farm scale biodiesel project
    - Malting barley trials since 2006
- Because of the terrain in Buffalo County, we need crops that are harvested early enough to support good growth of cover crops. Small grains fit this model, but the economics of small grain production limits the number of acres that will be planted at this time.

Industrial hemp seems like it might also fit the need with early harvest to allow for cover crop establishment.

- Industrial hemp may react well to manure applications.
- We have support from our local government and law enforcement officials
- We have support from local organizations such as the Buffalo county Farm Bureau, and from both conventional and organic farmers.

What we need to develop a research/demonstration program based on other research programs a minimum of $15,000 per year is needed to conduct the production study. Other funds and/or cooperative agreements with other states/universities needed for marketing and utilization of hemp fiber, beyond bedding:

- Seed – need to order soon as most is imported
- $ for operational expenses
    - Fuel
    - Student help
    - Seed
    - Fertilizer
    - etc
- $ for testing
    - Soil tests
    - Tissue tests
    - Seed yield
    - Fiber yield
    - THC levels
- Market study – visit to other states (some in person, some via technology)
- Fencing
- Land rent
- Meeting and reporting expenses

Other considerations:

- Hemp cross pollinates very easily, therefore, certified seed should be required each year. Producers should not be allowed to keep seed to avoid hemp plants with elevated THC levels. Incentives to establish a certified seed program should be considered. Wisconsin Certified Seed would be a logical entity to ensure that only certified seed was planted.
- A market study should be considered as hemp is a high quality fiber, but has not been used much in the United States for many years.

Major Resources:

Dr. Heather Darby, University of Vermont, Extension Agronomist.

Purdue University Industrial Hemp Initiative.

Congressional Research Service, Hemp as an Agricultural Commodity.