# Need to Reassess the U S Market Opportunity for Industrial Hemp

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# NEED TO REASSESS THE U S MARKET OPPORTUNITY FOR INDUSTRIAL HEMP

In 2000, the USDA reviewed the potential market opportunity for industrial hemp in the United States. With the re-introduction of industrial hemp production in Canada in 1998 and the development of new markets for industrial hemp globally, a new review of the opportunity for industrial hemp production in the U S is needed. This new study should assess both the success of and the lessons learned from the maturing Canadian industry; and the associated regulatory system to monitor production. It should also assess the opportunities associated with the developing world market for industrial hemp. Such a study will, therefore, need to include agencies beyond the USDA.

This paper summarizes the advantages and concerns associated with industrial hemp production in the U S as well as changes within the hemp industry over the past decade that support the need for a reassessment of the opportunity associated with U S hemp production.

# CURRENT STATUS OF HEMP IN THE U S

Industrial hemp has been grown for millennia throughout the world. In the Western Hemisphere, it is well suited for cultivation in all regions of the U S, as well as southern Canada, Latin America, and significant regions of South America. It will also grow in Australia; most regions of Europe; the mid- and southern regions of Asia; and large regions of northern, southern and eastern Africa. The primary issue with cultivating industrial hemp in the U S is that it is considered by the U S Drug Enforcement Administration (DEA) to be indistinguishable in appearance from marijuana. This is not a universal conclusion; and over 30 industrial countries do distinguish between industrial hemp and marijuana, and allow the production of industrial hemp. Since the early 1990s, both the European Union and Canada have reestablished industrial hemp production.

The distinction between hemp and marijuana is typically made on the content of THC (tetrahydrocannabinol), which was first isolated in 1964:

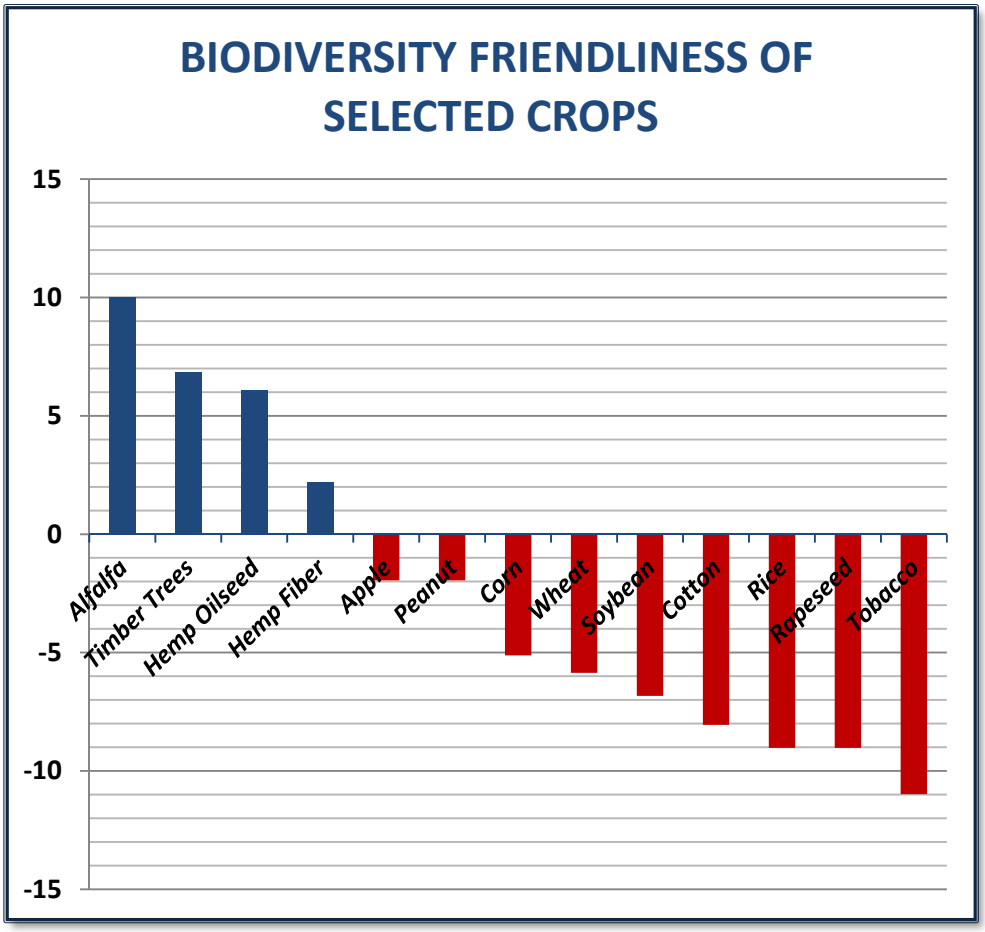
- A level of about 1% THC is considered the threshold for a psychoactive effect in humans
- Industrial hemp is associated with those cultivars containing less than 0.3% THC
- Marijuana cultivars typically contain 3-15% THC

In addition, growing industrial hemp and marijuana in the same field will detrimentally affect the yield of both crops. Nevertheless, current DEA policy considers industrial hemp and marijuana to be indistinguishable. Furthermore, the DEA is adamantly opposed to industrial hemp cultivation in the U S. The USDA has been mostly silent on this issue, while the American Farm Bureau changed its position to supporting research and domestic cultivation of industrial hemp in 1999.

## U S MARKET OPPORTUNITY FOR HEMP

Hemp is a very cost effective and environmentally friendly agricultural crop. Hemp requires little or no pesticides as it is naturally pest resistant. Hemp is also a natural herbicide, known for its ability to smother weeds when grown at a density suitable for producing high-quality bast fiber. Its deep root system is also very beneficial in preventing erosion, cleaning the ground, providing a disease break, and helping the soil structure by aerating the soil for future crops when it is grown in rotation with other crops. Finally, it absorbs carbon dioxide five (5) times more efficiently than the same acreage of forest.

Hemp is also a biodiversity friendly crop when compared to corn and soybeans, as shown in the figure below.




***Source: S. D. Montford (1996) and E. Small (1997)***

Industrial hemp production has experienced a global "renaissance" in the past 1-2 decades. This has been largely due to increased demand for biodegradable products; and the rapidly increasing global demand for annual renewable fiber and high quality health food products.

The industrial hemp market is typically divided into fiber production and seed production. China produces about 40% of the world's fiber supply; and about 80% of the world's seed supply. China recently announced plans to increase its hemp production in order to provide a major new source of fiber for the textile industry. This would reduce their textile industry's dependence on cotton; and in the process, free large areas of cotton-growing land for food production needed to support China's population. The objective is to increase China's current 50,000 acres of hemp production to 1+ million acres. However, for this effort to succeed, new technology is needed to remove the lignin that binds hemp fibers and prevents them from being spun.

The primary markets for European produced hemp are:

- Specialty pulp for cigarette paper, bank notes and similar applications that require its high tear strength and high wet strength
- Developing composite materials market for automotive applications
- Developing construction and thermal insulation applications

Hemp paper costs approximately six times that of wood pulp paper because of the limited supply of hemp; outdated, high-cost processing equipment; and the additional processing steps required to separate hemp pulp from hurds. The fact that hemp is only harvested once a year also adds to its costs as a raw material for paper. Therefore, specialty pulp is only used in applications that require its high tear and wet strength properties. Whether such markets could be developed in North America is questionable.

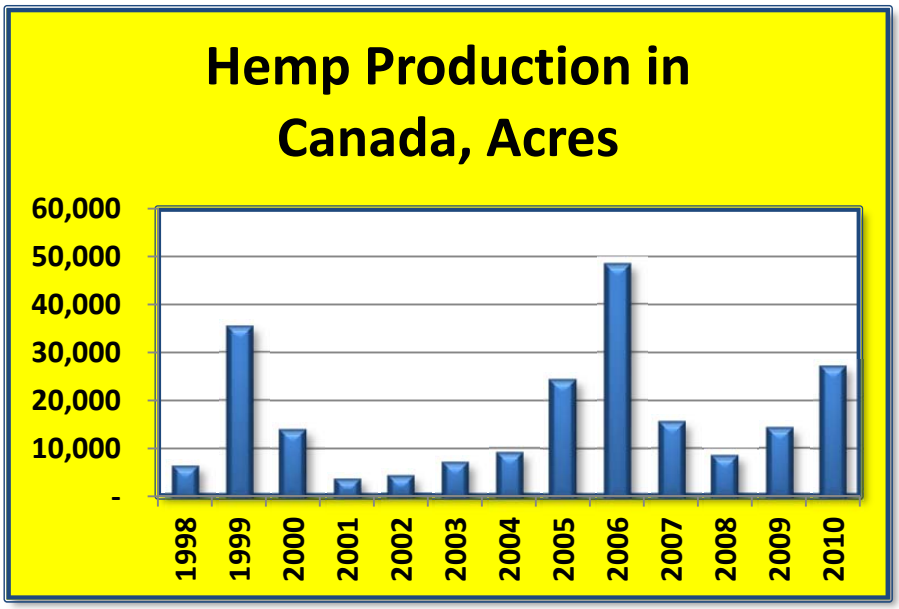
Hemp was introduced in automotive composites in Europe in 1996. It provides material that is easy to handle, has low environmental life cycle impact, and offers superior moisture diffusion and superior sound proofing when compared to fiberglass composites. Even though its cost is higher than fiberglass, about 19,000 tons of hemp were used within the German automotive industry in 2005, mainly as press-molded, injection-molded and press flow-molded parts. Virtually all European car makers and their suppliers are now using these materials for reinforced door panels, passenger rear decks, truck linings and pillars. This market is expected to continue to develop; and the possibility of a similar market development in North America is very good since most automotive supplier companies are global. In 1999-2000, 87% of European grown industrial hemp was used for specialty pulp and 6% was used for automotive composites. By 2003, this had shifted to 70-80% for specialty pulp and 15-20% for automotive composites.

Hemp hurds, the short fiber inner woody core of the hemp plant, make excellent animal bedding material, especially for horses that are allergic to straw. The hurds can absorb up to five (5) times their weight in moisture; this is about 50% higher than wood shavings. They also compost easily. Hemp processors in Europe depend on the sale of hurds to maintain their company profitability. A similar market could be developed in North America; as in Europe, its development may be essential to industry profitability.

Hemp seeds and hemp oil are also a potentially valuable market opportunity. The seeds have exceptional nutritional value. They are second only to soybeans as a source of complete vegetable protein; and hemp seeds contain all 8 essential amino acids in the correct proportions humans require. Hemp seeds also contain 29-34% oil by weight. Hemp seed oil is approximately 80% polyunsaturated essential fatty acids. Furthermore, the proportion of these

oils in hemp seeds closely matches the ratios most beneficial to human nutrition. Therefore, seeds offer another market opportunity for industrial hemp. There is one issue, however: this high percentage of polyunsaturated fats also makes hemp seed oil somewhat unstable and subject to fairly rapid rancidity, unless preserved or processed appropriately. Because of its fat components, hemp oil should not be used for frying.

In 1998, Canada re-established industrial hemp production. It often takes 10-15 years for a new agricultural industry to mature; and over the past 10+ years Canadian production has suffered growing pains, as shown in the figure below. But, it is now considered to be maturing; and with no U S production, it is expected to become a major supplier for U S hemp products.




Currently, the Canadian hemp market uses seeds from Europe. However, for optimal yield and to meet the characteristics of developing hemp markets, new cultivars appropriate for the North America climate and market need to be developed. This is in addition to establishing a cost-effective processing infrastructure for the industry in North America.

## HEMP PRODUCTION ECONOMICS

There are two potentially viable approaches to growing hemp commercially: growing hemp for fiber or for seed. If hemp is grown for fiber, it is sown very densely (a seed rate of 300-380 lbs/acre is standard). Since hemp grows quickly, at this density it can effectively out compete with weeds; and herbicides are not needed. If hemp is grown for seed and/or oil, it is grown much less densely (typically 55-80 lbs/acre); this is not as effective at suppressing weeds, so herbicides will be required. Hemp seed can be drilled or broadcast, though drilling is recommended for uniformity. A standard grain drill or modified alfalfa seeder can be used for sowing.

Pesticides are generally considered unnecessary in the cultivation of hemp; however, hemp does have significant nutrient demands. Once the seeds are planted, no further husbandry is required until harvest, thus, minimizing labor costs and energy consumption. Irrigation, however, is required if precipitation is less than 8 inches over the course of the growing period.

Currently, one of the most significant costs of growing hemp for fiber is the cost of seeds because there are no domestic sources that ensure seed strains that meet the generally accepted THC level of <0.3%. Not only are the transportation costs high (over half of the seed cost); but certified seed demands a substantial premium. As a result, certified seed currently cost $62 -$79 per acre.

Hemp yields can vary radically; and until cultivars are developed for U S conditions, it can only be stated that there are opportunities to significantly improve existing productivity. Experts also believe that production costs can be lowered by exploiting hemp as a dual-purpose crop; i.e., providing both fiber and seed from the same plant.

From available information, producer returns from raising hemp are expected to be similar to corn but better than soybeans raised on high productivity farmland: $600 - $1,000 per acre. Using data available from the University of Illinois Department of Agricultural and Consumer Economics (see Appendix A), operator return is estimated at $50 - $250 per acre once domestic seed sources are available.

Although flax processing equipment has been shown to be adequate for processing hemp, specifically designed equipment would be more effective and less costly. As mentioned earlier, pressing hemp seed for oil requires special handling to avoid spoilage; but advanced seed oil companies have already developed proprietary technology using inert gases and vacuums that provide oil products with a shelf life of over one year.

## REGULATORY ISSUES

The most critical issue associated with hemp production is the possibility it could allow covert growing of marijuana. Indeed, this is the reason hemp cultivation was made illegal in North America in the mid 20$^{th}$ century. It is now well documented that hemp will contaminate marijuana plants and significantly lower their THC content; therefore, marijuana growers generally avoid hemp fields. In addition, hemp is harvested much earlier than field grown marijuana, making it detrimental for the two plants to share fields. Nevertheless, U S law enforcement authorities do not believe they can differentiate between hemp and marijuana grown in fields. In response to this concern, Canada and European Union countries have developed stringent laws and regulatory procedures to oversee hemp production that ensures that only low THC plant varieties are approved for agricultural production. U S law enforcement authorities cite the resulting costs associated with regulating the industry as another reason for prohibiting hemp production in the U S. Conversely, proponents point to the burgeoning international industry as an opportunity for U S farmers.

Canada can provide a benchmark for what a U S regulatory system would require. Health Canada is the agency with primary responsibility for overseeing the regulatory program that was developed for industrial hemp production by their Office of Controlled Substances. The Industrial Hemp Regulations (IHR) were developed in 1998 as part of Canada's Controlled Drugs and Substances Act (CDSA) to allow for strict regulation of industrial hemp production and make a clear distinction between industrial hemp and other forms of *Cannabis*. These regulations and procedures build on those developed within the European Union in the 1990s. The following are included in the regulations:

- Importers and exporters of industrial hemp, in the form of seed or viable grain, need to be licensed; and in addition to holding a license, they are also required to obtain a permit for each shipment

- The importer must ensure that shipments of viable grain are accompanied by foreign certification; a list of countries having equivalent controls on the production of viable grain is maintained and only grain from these countries can be imported

- Seed growers are restricted to minimum plots of one acre and are required to demonstrate current membership in the Canadian Seed Growers Association; they are also required to state the number of acres grown in the previous two years as part of their license application

- Plant breeders must be registered with the Canadian Seed Growers Association and may only cultivate industrial hemp in accordance with stated regulations

- Growers of fiber or viable grain need a license before they can purchase seeds or cultivate industrial hemp; they must provide the number of acres grown in the previous two years as part of their license application, which must also provide Global Positioning System coordinates for cultivated sites and an accompanying map showing the site locations in terms of their legal descriptions, a statement that the applicant is the owner of the land or has rights to use the land, and the address where records required by the regulations will be maintained

- Only pedigreed seeds of approved varieties may be planted

- Licenses and audit trails are required for processing activities such as pressing seeds into oil; only a person resident in Canada can maintain these records

- To obtain any license – be it for importation, exportation, production or sale of industrial hemp – applicants are required to produce a police security check

- Authorizations are required for transportation when products leave the control of a license holder or for testing

- No person is allowed to advertize that a product or a derivative is psychoactive

- Every person legally cultivating industrial hemp must submit samples of their crop to a licensed and accredited laboratory to ensure that the THC level is at or below 0.3%

Producers must also ensure that all equipment used to sow or harvest hemp is thoroughly cleaned after each use to avoid the inadvertent dissemination of industrial hemp. In addition, at the time of harvesting, all branches, leaves and flowering heads of the plant must be destroyed in a manner that eliminates their use for any purpose not granted to the license holder. Storage of hemp must be done in a locked container or locked location to which only authorized persons have access. Finally, cultivation of industrial hemp within one kilometer of any school grounds or any other public place frequented by persons under the age of 18 is prohibited.

The Royal Mounted Canadian Police believe that, under these regulations, industrial hemp production in Canada has not contributed to a rise in marijuana activity or arrests.

If the U S were to adopt similar regulations, one concern is the associated cost, including required testing. Health Canada personnel have not published annual cost data for maintaining their regulatory program. However, it is evident from the number of people, laboratories and hours dedicated to enforcing the regulations that their program requires significant financial commitment. The Minnesota Department of Agriculture has estimated it would require about $600,000 annually to provide for basic industrial hemp regulation and THC testing in their state. These costs do not include any impact the regulations would have on law enforcement activities.

***This report was prepared with the assistance of the Virginia Tech Business Technology Center.***

# APPENDIX A

## Corn and Soybean Returns for 2008, 2009P, and 2010P
## Central Illinois – High Productivity Farmland

***Source: University of Illinois Department of Agricultural and Consumer Economics***

| | Corn | | | Soybeans | | |
|---|---|---|---|---|---|---|
| | **2008** | **2009P** | **2010P** | **2008** | **2009P** | **2010P** |
| Yield/ Acre | 199 | 200 | 192 | 50 | 51 | 55 |
| Price /Bushel | $4.5 | $3.25 | $3.75 | $10.15 | $9.40 | $10.00 |
| Crop Revenue | $806 | $650 | $720 | $508 | $479 | $550 |
| ACRE Revenue | 0 | 25 | 0 | 0 | 0 | 0 |
| Other Gov't Revenue | 25 | 24 | 24 | 25 | 24 | 24 |
| Crop Insurance Proceeds | 22 | 20 | 0 | 25 | 4 | 0 |
| ***Gross Revenues/Acre*** | ***$853*** | ***$719*** | ***$744*** | ***$558*** | ***$507*** | ***$574*** |
| | | | | | | |
| Fertilizer | 124 | 170 | 95 | 42 | 85 | 50 |
| Pesticides | 46 | 50 | 50 | 28 | 30 | 30 |
| Seed | 67 | 95 | 100 | 43 | 52.5 | 55 |
| Drying & Storage | 30 | 36 | 30 | 6 | 7 | 7 |
| Crop Insurance | 27 | 27 | 27 | 18 | 17 | 17 |
| ***Total Direct Costs*** | ***$294*** | ***$378*** | ***$302*** | ***$137*** | ***$192*** | ***$159*** |
| Fuel and oil | 22 | 20 | 17 | 19 | 18 | 17 |
| Machine repair | 17 | 18 | 18 | 14 | 14 | 14 |
| Machine Depreciation | 29 | 30 | 30 | 26 | 27 | 27 |
| Other | 14 | 16 | 16 | 11 | 11 | 11 |
| ***Tower Power Costs*** | ***$82*** | ***$84*** | ***$81*** | ***$70*** | ***$70*** | ***$69*** |
| Hired labor | 11 | 11 | 11 | 10 | 10 | 10 |
| Insurance | 10 | 10 | 10 | 10 | 10 | 10 |
| Interest (non-land) | 14 | 18 | 20 | 13 | 17 | 19 |
| Other | 17 | 16 | 16 | 13 | 13 | 13 |
| ***Total Overhead Costs*** | ***$52*** | ***$55*** | ***$57*** | ***$46*** | ***$50*** | ***$52*** |
| ***Operator & Land Return*** | ***$425*** | ***$202*** | ***$304*** | ***$305*** | ***$196*** | ***$294*** |
| Cash Rent | 197 | 210 | 210 | 197 | 210 | 210 |
| ***Operator Return/Acre*** | ***$228*** | ***-$8*** | ***$94*** | ***$108*** | ***-$15*** | ***$84*** |

# APPENDIX B
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