

Hemp as an Agricultural Commodity

(name redacted)

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Summary

Industrial hemp is an agricultural commodity that is cultivated for use in the production of a wide range of products, including foods and beverages, cosmetics and personal care products, and nutritional supplements, as well as fabrics and textiles, yarns and spun fibers, paper, construction and insulation materials, and other manufactured goods. Hemp can be grown as a fiber, seed, or other dual-purpose crop. Some estimate that the global market for hemp consists of more than 25,000 products. Precise data are not available on the size of the U.S. market for hemp-based products, but current industry estimates report annual sales at more than \$580 million annually.

Hemp is a variety of *Cannabis sativa* and is of the same plant species as marijuana. Although industrial hemp is genetically different and distinguished by its use and chemical makeup, and has long been cultivated for non-drug use in the production of industrial and other goods, in the United States, hemp is subject to U.S. drug laws and growing industrial hemp is restricted. Under current U.S. drug policy all cannabis varieties, including industrial hemp, are considered Schedule I controlled substances under the Controlled Substances Act (CSA, 21 U.S.C. §§801 *et seq.*; Title 21 C.F.R. Part 1308.11). Despite these legitimate industrial uses, hemp production and usage are controlled and regulated by the U.S. Drug Enforcement Administration (DEA). Strictly speaking, the CSA does not make growing hemp illegal; rather, it places strict controls on its production and enforces standards governing the security conditions under which the crop must be grown, making it illegal to grow without a DEA permit. In other words, a grower needs to get permission from the DEA to grow hemp or faces the possibility of federal charges or property confiscation, regardless of whether the grower has a state-issued permit. Currently, cannabis varieties may be legitimately grown for research purposes only. No known active federal licenses allow for hemp cultivation at this time. There is no large-scale commercial hemp production in the United States, and the U.S. market is largely dependent on imports, both as finished hemp-containing products and as ingredients for use in further processing. More than 30 nations grow industrial hemp as an agricultural commodity, which is sold on the world market.

In the early 1990s a sustained resurgence of interest in allowing commercial cultivation of industrial hemp began in the United States. Several states have conducted economic or market studies, and have initiated or passed legislation to expand state-level resources and production.

The 113th Congress made significant changes to U.S. policies regarding industrial hemp during the omnibus farm bill debate. The Agricultural Act of 2014 (“farm bill,” P.L. 113-79; 7 U.S.C. 5940) provided that certain research institutions and state departments of agriculture may grow industrial hemp, as part of an agricultural pilot program, if allowed under state laws where the institution or state department of agriculture is located. The farm bill also established a statutory definition of “industrial hemp” as the plant *Cannabis sativa* L. and any part of such plant with a delta-9 tetrahydrocannabinol (THC) concentration of not more than 0.3% on a dry weight basis. The FY2016 omnibus appropriations act (P.L. 114-113) blocks federal law enforcement authorities from interfering with state agencies, hemp growers, and agricultural research (§543) and also blocks USDA from prohibiting the transportation, processing, sale, or use of industrial hemp that is grown or cultivated (§763) in accordance with the 2014 farm bill provision.

As introduced in the 114th Congress, the Industrial Hemp Farming Act of 2015 (H.R. 525; S. 134) would amend the CSA to specify that the term “marijuana” does not include industrial hemp, thus excluding hemp from the CSA as a controlled substance subject to DEA regulation. This bill was reintroduced from bills introduced in previous Congresses dating back to the 109th Congress. In addition, bills have been introduced in both the House (H.R. 1635) and the Senate (S. 1333) that would amend the CSA “to exclude cannabidiol and cannabidiol-rich plants from the definition of marihuana” intended to promote the possible medical applications of hemp.

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Introduction

For centuries, industrial hemp (plant species *Cannabis sativa*) has been a source of fiber and oilseed used worldwide to produce a variety of industrial and consumer products. Currently, more than 30 nations grow industrial hemp as an agricultural commodity, which is sold on the world market. In the United States, however, production is strictly controlled under existing drug enforcement laws. Currently there is no large-scale commercial production in the United States, and the U.S. market depends on imports.

The 113th Congress made significant changes to U.S. policies regarding industrial hemp during the omnibus farm bill debate. The Agricultural Act of 2014 (P.L. 113-79; 7 U.S.C. 5940) provided that certain research institutions and state departments of agriculture may grow industrial hemp, as part of an agricultural pilot program, if allowed under state laws where the institution or state department of agriculture is located. The enacted FY2016 omnibus appropriations blocks federal law enforcement authorities from interfering with state agencies, hemp growers, and agricultural research (P.L. 114-113, §543) and also blocks the U.S. Department of Agriculture (USDA) from prohibiting the transportation, processing, sale, or use of industrial hemp that is grown or cultivated (P.L. 114-113, §763) in accordance with the 2014 farm bill provision.

The 114th Congress has reintroduced the Industrial Hemp Farming Act of 2015 (H.R. 525 and S. 134), which would exclude industrial hemp from being regulated as a controlled substance and subject to certain federal law enforcement authorities. In addition, bills have been introduced in both the House (H.R. 1635) and the Senate (S. 1333) that would amend the Controlled Substances Act (CSA) “to exclude cannabidiol and cannabidiol-rich plants from the definition of marihuana” and are intended to promote the possible medical applications of hemp.

Overview of *Cannabis* Varieties

Although marijuana is also a variety of cannabis, it is genetically distinct from industrial hemp and is further distinguished by its use and chemical makeup.

In this report, “hemp” refers to industrial hemp, “marijuana” (or “marihuana” as it is spelled in the older statutes) refers to the psychotropic drug (whether used for medicinal or recreational purposes), and “cannabis” refers to the plant species that has industrial, medicinal, and recreational varieties.¹

Comparison of Hemp and Marijuana

There are many different varieties of cannabis plants. Marijuana and hemp come from the same species of plant, *Cannabis sativa*, but from different varieties or cultivars. However, hemp is genetically different and is distinguished by its use and chemical makeup, as well as by differing cultivation practices in its production.²

¹ This report does not cover issues pertaining to medical or recreational marijuana. For other information, see CRS Report R43034, *State Legalization of Recreational Marijuana: Selected Legal Issues*, and CRS Report R43435, *Marijuana: Medical and Retail—Selected Legal Issues*, among other related CRS reports.

² See, for example, S. L. Datwyler and G. D. Weiblen, “Genetic Variation in Hemp and Marijuana (*Cannabis sativa* L.) According to Amplified Fragment Length Polymorphisms,” *Journal of Forensic Sciences*, vol. 51, no. 2 (2006).

Hemp, also called “industrial hemp,”³ refers to cannabis varieties that are primarily grown as an agricultural crop (such as seeds and fiber, and by-products such as oil, seed cake, hurds) and is characterized by plants that are low in THC (delta-9 tetrahydrocannabinol, marijuana’s primary psychoactive chemical). THC levels for hemp are generally less than 1%.

Marijuana refers to the flowering tops and leaves of psychoactive cannabis varieties, which are grown for their high content of THC. Marijuana’s high THC content is primarily in the flowering tops and to a lesser extent in the leaves. THC levels for marijuana are much higher than for hemp and are reported to average about 10%; some sample tests indicate THC levels reaching 20%-30%, or greater.⁴

A level of about 1% THC is considered the threshold for cannabis to have a psychotropic effect or an intoxicating potential.⁵ Current laws regulating hemp cultivation in the European Union (EU) and Canada use 0.3% THC as the dividing line between industrial and potentially drug-producing cannabis. Cultivars having less than 0.3% THC can be cultivated under license, while cultivars having more than that amount are considered to have too high a drug potential.⁶

Some also claim that industrial hemp has higher levels of cannabidiol (CBD), the non-psychoactive part of marijuana, which might mitigate some of the effects of THC.⁷ A high ratio of CBD to THC might also classify hemp as a fiber-type plant rather than a drug-type plant. Opinions remain mixed about how CBD levels might influence the psychoactive effects of THC.

Production Differences

Production differences depend on whether the cannabis plant is grown for fiber/oilseed or for medicinal/recreational uses. These differences involve the varieties being grown, the methods used to grow them, and the timing of their harvest (see discussion in “Hemp” and “Marijuana,” below). Concerns about cross-pollination among the different varieties are critical. All cannabis plants are open, wind, and/or insect pollinated, and thus cross-pollination is possible.

Because of the compositional differences between the drug and fiber varieties of cannabis, farmers growing either crop would necessarily want to separate production of the different varieties or cultivars. This is particularly true for growers of medicinal or recreational marijuana in an effort to avoid cross-pollination with industrial hemp, which would significantly lower the THC content and thus degrade the value of the marijuana crop. Likewise, growers of industrial hemp would seek to avoid cross-pollination with marijuana plants, especially given the illegal

³ Use of this term dates back to the 1960s; see L. Grlic, “A Combined Spectrophotometric Differentiation of Samples of Cannabis,” United Nations Office on Drugs and Crime (UNODC), January 1968, http://www.unodc.org/unodc/en/data-and-analysis/bulletin/bulletin_1968-01-01_3_page005.html.

⁴ National Institute of Drug Abuse, “Quarterly Report, Potency Monitoring Project,” Report 100, University of Mississippi, 2008. Based on sample tests of illegal cannabis seizures (December 16, 2007, through March 15, 2008).

⁵ E. Small and D. Marcus, “Hemp: A New Crop with New Uses for North America,” in *Trends in New Crops and New Uses*, ed. J. Janick and A. Whipkey (Alexandria, VA: American Society for Horticultural Science [ASHS] Press, 2002).

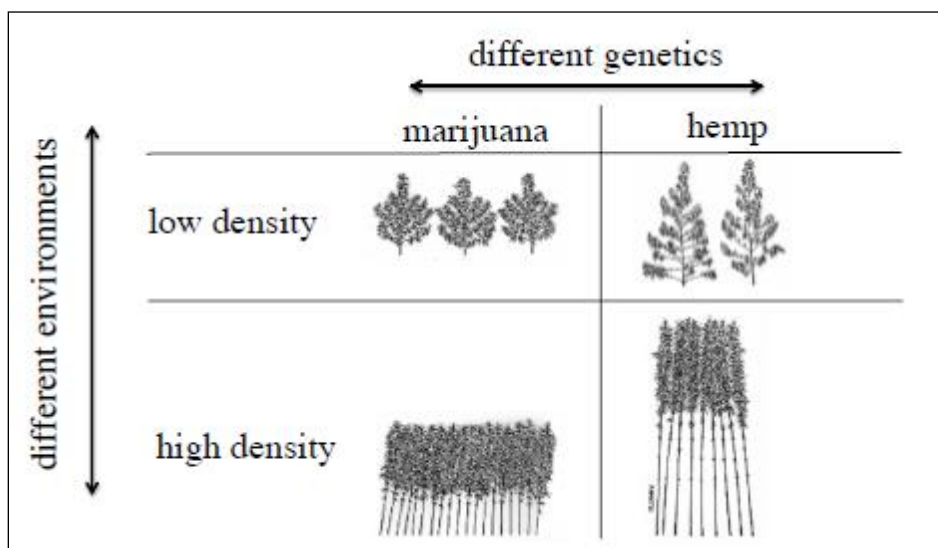
⁶ E. Small and D. Marcus, “Tetrahydrocannabinol Levels in Hemp (*Cannabis sativa*) Germplasm Resources,” *Economic Botany*, vol. 57, no. 4 (October 2003); and G. Leson, “Evaluating Interference of THC Levels in Hemp Food Products with Employee Drug Testing” (prepared for the province of Manitoba, Canada), July 2000.

⁷ U. R. Avico, R. Pacifici, and P. Zuccaro, “Variations of Tetrahydrocannabinol Content in Cannabis Plants to Distinguish the Fibre-Type from Drug-Type Plants,” *UNODC Bulletin on Narcotics*, January 1985; C. W. Waller, “Chemistry of Marihuana,” *Pharmacological Reviews*, vol. 23 (December 1971); K. W. Hillig and P. G. Mahlberg, “A Chemotaxonomic Analysis of Cannabinoid Variation in *Cannabis* (Cannabaceae),” *American Journal of Botany*, vol. 91, no. 6 (June 2004); and A. W. Zuardi et al., “Cannabidiol, a *Cannabis sativa* Constituent, as an Antipsychotic Drug,” *Brazilian Journal of Medical and Biological Research*, vol. 39 (2006).

status of marijuana. Plants grown for oilseed are also marketed according to the purity of the product, and the mixing of off-type genotypes would degrade the value of the crop.⁸

The different cannabis varieties are also harvested at different times (depending on the growing area), increasing the chance of detection of illegal marijuana, if production is commingled. Because of these differences, many claim that drug varieties of cannabis cannot easily be grown with oilseed or fiber varieties without being easily detected.⁹ As discussed below (and illustrated in **Figure 1**), among the visual plant differences are **plant height** (hemp is encouraged to grow tall, whereas marijuana is selected to grow short and tightly clustered); **cultivation** (hemp is grown as a single main stalk with few leaves and branches, whereas marijuana is encouraged to become bushy with many leaves and branches to promote flowers and buds); and **planting density** (hemp is densely planted to discourage branching and flowering, whereas marijuana plants are well-spaced).

Figure 1. Trait Variation in Cannabis Phenotype
(marijuana and industrial hemp)



Source: George Weiblen, University of Minnesota, presentation at the 2013 Annual HIA Conference, Washington, DC, November 17, 2013.

Notes: Photographs contrasting marijuana and industrial hemp are available at Vote Hemp's website ("Different Varieties of Cannabis," http://www.votehemp.com/different_varieties.html).

Hemp

To maximize production of hemp fiber and/or seed, plants are encouraged to grow taller in height. Cultivated plants become a tall stalky crop that usually reaches between 6 and 15 feet and generally consist of a single main stalk with few leaves and branches. Hemp plants grown for fiber or oilseed are planted densely (about 35-50 plants per square foot)¹⁰ to discourage branching

⁸ CRS communication with Anndrea Hermann, Hemp Oil Canada Inc., December 2009. Pollen is present at a very early plant development stage.

⁹ D. P. West, "Hemp and Marijuana: Myths & Realities," February 1998, <http://www.gametec.com/hemp/hempandmj.html>. Also see information posted by Vote Hemp Inc., "Different Varieties of Cannabis" (no date), http://www.votehemp.com/different_varieties.html.

¹⁰ Innvista, "Hemp Biology," September 25, 2012, <http://www.innvista.com/health/foods/hemp/hemp-biology/>.

and flowering. The period of seeding to harvest ranges from 70 to 140 days, depending on the purpose, cultivar or variety, and climatic conditions. The stalk and seed is the harvested product. The stalk of the plant provides two types of fibers: the outer portion of the stem contains the bast fibers, and the interior or core fiber (or hurds).

Industrial hemp production statistics for Canada indicate that one acre of hemp yields an average of about 700 pounds of grain, which can be pressed into about 50 gallons of oil and 530 pounds of meal.¹¹ That same acre will also produce an average of 5,300 pounds of straw, which can be transformed into about 1,300 pounds of fiber.

Marijuana

When cannabis is grown to produce marijuana, it is cultivated from varieties where the female flowers of dioecious drug strains are selected to prevent the return of separate male and female plants.¹² The female flowers are short and tightly clustered. In marijuana cultivation, growers remove all the male plants to prevent pollination and seed set. Some growers will hand-pollinate a female plant to get seed; this is done in isolation of the rest of the female plants. The incorporation and stabilization of monoecism in cannabis cultivation requires the skill of a competent plant breeder and rarely occurs under non-cultivated conditions.

If marijuana is grown in or around industrial hemp varieties, the hemp would pollinate the female marijuana plant. Marijuana growers would not want to plant near a hemp field, since this would result in a harvest that is seedy and lower in THC, and degrade the value of their marijuana crop.

Marijuana is cultivated to encourage the plant to become bushy with many leaves, with wide branching to promote flowers and buds. This requires that plants be well-spaced, by as much as about 1-2 plants per square yard.¹³ The flower and leaves are the harvested products.

Hemp Production and Use

Commercial Uses of Hemp

Industrial hemp can be grown as a fiber, seed, or dual-purpose crop.¹⁴ The interior of the stalk has short woody fibers called hurds; the outer portion has long bast fibers. Hemp seed/grains are smooth and about one-eighth to one-fourth of an inch long.¹⁵

Although hemp is not grown in the United States, both finished hemp products and raw material inputs are imported and sold for use in manufacturing for a wide range of product categories (**Figure 2**). Hemp fibers are used in a wide range of products, including fabrics and textiles, yarns and spun fibers, paper, carpeting, home furnishings, construction and insulation materials, auto parts, and composites. Hurds are used in various applications such as animal bedding, material

¹¹ Agriculture and Agri-Food Canada, "Industrial Hemp" (no date), <http://www4.agr.gc.ca/>.

¹² H. van Bakel et al., "The Draft Genome and Transcriptome of *Cannabis sativa*," *Genome Biology*, vol. 12, issue 10, 2011. In botany, dioecious is a term describing plant varieties that possess male and female flowers or other reproductive organs on separate, individual plants.

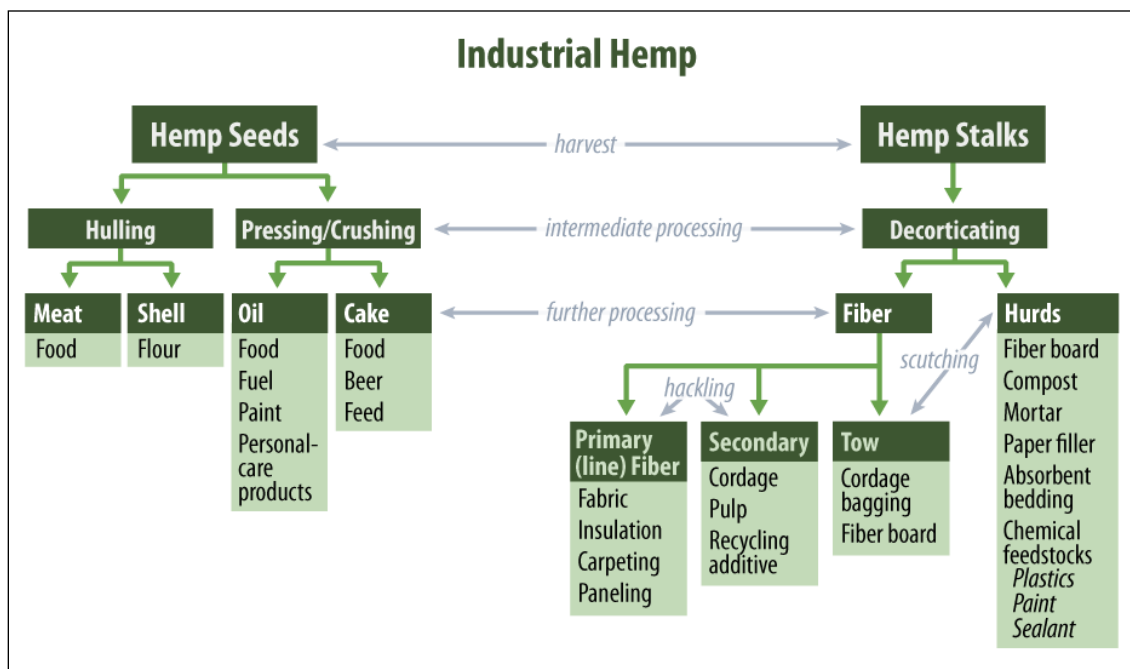
¹³ Innvista, "Hemp Biology," September 25, 2012, <http://www.innvista.com/health/foods/hemp/hemp-biology/>.

¹⁴ Different varieties have been developed may be better suited for one use or the other. Cultivation practices also differ depending upon the variety planted.

¹⁵ For additional information, see U.S. Department of Agriculture, Economic Research Service, *Industrial Hemp in the United States: Status and Market Potential*, ERS Report AGES001E, January 2000.

inputs, papermaking, and composites. Hemp seed and oilcake are used in a range of foods and beverages, and can be an alternative food protein source. Oil from the crushed hemp seed is used as an ingredient in a range of body-care products and nutritional supplements.¹⁶ Hemp seed is also used for industrial oils, cosmetics and personal care products, and pharmaceuticals, among other composites.

Figure 2. Flowchart of Potential Hemp Products



Source: CRS, adapted from D. G. Kraenzel et al., "Industrial Hemp as an Alternative Crop in North Dakota," AER-402, North Dakota State University, July 23, 1998.

Some estimate that the global market for hemp consists of more than 25,000 products in nine submarkets: agriculture; textiles; recycling; automotive; furniture; food/nutrition/beverages; paper; construction materials; and personal care. For construction materials, such as hempcrete (a mixture of hemp hurds and lime products), hemp is used as a lightweight insulating material.¹⁷ Hemp has also been promoted as a potential biodiesel feedstock,¹⁸ although some analysts suggest that competing demands for other products might make it too costly to use as a feedstock.¹⁹

¹⁶ Some have suggested similarities between hempseed oil and hash oil. However, there is evidence suggesting differences regarding initial feedstock or input ingredients (hash oil requires high-THC marijuana, whereas hempseed oil uses low-THC industrial hemp); how they are produced (hash oil is extracted often using a flammable solvent, whereas hempseed oil is expeller-pressed or extracted mechanically, generally without chemicals or additives); and how they are used (hash oil is used as a psychoactive drug, whereas hempseed oil is used as an ingredient in hemp-based foods, supplements, and body care products). For more background information, contact the author of this report.

¹⁷ "Hemp Homes Are Cutting Edge of Green Building," *USA Today*, September 12, 2010; and "Construction Plant," *Financial Times*, January 22, 2010.

¹⁸ Manitoba Agriculture, *National Industrial Hemp Strategy*, March 2008, p. 293; J. Lane, "Hemp Makes Comeback as Biofuels Feedstock in 43-Acre California Trial," *Biofuels Digest*, August 24, 2009; and H. Jessen, "Hemp Biodiesel: When the Smoke Clears," *Biodiesel Magazine*, February 2007.

¹⁹ North Dakota State University, "Biofuel Economics: Biocomposites—New Uses for North Dakota Agricultural (continued...)"

These types of commercial uses are widely documented in a range of feasibility and marketing studies conducted by researchers at the U.S. Department of Agriculture (USDA) and various land grant universities and state agencies. (A listing of these studies is in the **Appendix**.)

Estimated Retail Market

No official estimates are available of the value of U.S. sales of hemp-based products. The Hemp Industries Association (HIA) estimates that the total U.S. retail value of hemp products in 2014 was \$620 million, which includes food and body products, clothing, auto parts, building materials, and other products.²⁰ Of this, HIA reports that the value of hemp-based food, supplements, and body care sales in the United States totaled \$184 million. Previous reports about the size of the U.S. market for hemp clothing and textiles are estimated at about \$100 million annually.²¹

The reported retail value of the U.S. hemp market is an estimate and is difficult to verify. Underlying data for this estimate are from SPINS survey data,²² however, because the data reportedly do not track retail sales for The Body Shop and Whole Foods Market—two major markets for hemp-based products—as well as for restaurants, hemp industry analysts have adjusted these upward to account for this gap in the reported survey data.²³

Available industry information indicates that sales of some hemp-based products, such as foods and body care products, are growing.²⁴ Growth in hemp specialty food products is driven, in part, by sales of hemp milk and related dairy alternatives, among other hemp-based foods.²⁵

Information is not available on other potential U.S. hemp-based sectors, such as for use in construction materials or biofuels, paper, and other manufacturing uses. Data are not available on existing businesses or processing facilities that may presently be engaged in such activities within the United States.

U.S. Hemp Imports

The import value of hemp-based products imported and sold in the United States is difficult to estimate accurately. For some traded products, available statistics have only limited breakouts or have been expanded only recently to capture hemp subcategories within the broader trade categories for oilseeds and fibers. Reporting errors are evident in some of the trade data, since reported export data for hemp from Canada do not consistently match reported U.S. import data for the same products (especially for hemp seeds).

(...continued)

Fibers and Oils” (no date).

²⁰ HIA, “2014 Annual Retail Sales for Hemp Products Estimated at \$620 Million,” March 12, 2015.

²¹ HIA, “Hemp Fabric Goes High Fashion,” February 11, 2008. Estimate reflects best available current information based on personal communication between CRS and HIA.

²² SPINS tracks data and market trends on natural product industry sales (<http://www.spins.com/>).

²³ CRS communication with representatives of Vote Hemp, Inc., May 2010. See also HIA’s press release, “Growing Hemp Food and Body Care Sales Is Good News for Canadian Hemp Seed and Oil Producers,” April 29, 2009.

²⁴ H. Fastre, chief executive officer of Living Harvest Foods, based on his comments and presentation, “The Future of Hemp,” HIA Convention, Washington DC, October 2009; and HIA, “Growing Hemp Food and Body Care Sales Is Good News for Canadian Hemp Seed and Oil Producers,” April 29, 2009.

²⁵ HIA, “Hemp Milk Products Boosted Growth of Hemp Food Market in 2007,” March 14, 2008.

Given these data limitations, available trade statistics indicate that the value of U.S. imports under categories actually labeled “hemp,” such as hemp seeds and fibers, which are more often used as inputs for use in further manufacturing, was nearly \$36.9 million in 2013. Compared to available data for 2005, the value of imported hemp products for use as inputs and ingredients has increased more than sixfold. However, import volumes for other products, such as hemp oil and fabrics, are lower (**Table 1**). Trade data are not available for finished products, such as hemp-based clothing or other products including construction materials, carpets, or paper products.

The single largest supplier of U.S. imports of raw and processed hemp fiber is China. Other leading country suppliers include Romania, Hungary, India, and other European countries. The single largest source of U.S. imports of hemp seed and oilcake is Canada. The total value of Canada’s exports of hemp seed to the United States has grown significantly in recent years following resolution of a long-standing legal dispute over U.S. imports of hemp foods in late 2004 (see “Dispute over Hemp Food Imports (1999-2004)”). European countries such as the United Kingdom and Switzerland also have supplied hemp seed and oilcake to the United States.

U.S. Market Potential

In the past two decades, several feasibility and marketing studies have been conducted by researchers at the USDA and various land grant universities and state agencies (for example, Arkansas, Kentucky, Maine, Minnesota, North Dakota, Oregon, and Vermont; see **Appendix**).

Studies by researchers in Canada and various state agencies provide a mostly positive market outlook for growing hemp, citing rising consumer demand and the potential range of product uses for hemp. Some state reports claim that if current restrictions on growing hemp in the United States were removed, agricultural producers in their states could benefit. A 2008 study reported that acreage under cultivation in Canada, “while still showing significant annual fluctuations, is now regarded as being on a strong upward trend.” Most studies generally note that “hemp ... has such a diversity of possible uses, [and] is being promoted by extremely enthusiastic market developers.” Other studies highlight certain production advantages associated with hemp or acknowledge hemp’s benefits as a rotational crop or further claim that hemp may be less environmentally degrading than other agricultural crops. Some studies also claim certain production advantages to hemp growers, such as relatively low input and management requirements for the crop.

Other studies focused on the total U.S. market differ from the various state reports and provide a less favorable aggregate view of the potential market for hemp growers in the United States. Two studies, conducted by researchers at USDA and University of Wisconsin-Madison (UW-M), highlight some of the continued challenges facing U.S. hemp producers.

For example, USDA’s study projected that U.S. hemp markets “are, and will likely remain, small, thin markets” and also cited “uncertainty about long-run demand for hemp products and the potential for oversupply” among possible downsides of potential future hemp production.

Table 1. Value and Quantity of U.S. Imports of Selected Hemp Products, Selected Years, 1996-2013

	Units	1996	2000	2005	2009	2010	2011	2012	2013
Hemp Seeds (HS 1207990220) ^a	\$1000	—	—	271	3,320	5,154	6,054	13,057	26,710
Hemp Oil and Fractions (HS 1515908010)	\$1000	—	—	3,027	1,042	1,833	1,146	1,098	2,264
Hemp Seed Oilcake and Other Solids (HS 2306900130)	\$1000	—	—	—	1,811	2,369	2,947	4,388	6,279
True Hemp, raw/processed not spun (HS 5302)	\$1000	100	577	228	114	94	181	157	78
True Hemp Yarn (HS 5308200000)	\$1000	25	640	904	568	296	580	496	478
True Hemp Woven Fabrics (HS 5311004010)	\$1000	1,291	2,258	1,232	894	1,180	1,363	1,363	1,057
Total		1,416	3,475	5,662	7,749	10,926	12,271	20,559	36,866
Hemp Seeds (HS 1207990220) ^a	metric ton	—	—	92	602	711	623	1,237	2,272
Hemp Oil and Fractions (HS 1515908010)	metric ton	—	—	287	128	215	157	208	450
Hemp Seed Oilcake and Other Solids (HS 2306900130)	metric ton	—	—	—	201	240	298	441	601
True Hemp, raw/processed not spun (HS 5302)	metric ton	53	678	181	83	42	89	66	72
True Hemp Yarn (HS 5308200000)	metric ton	6	89	113	76	42	86	88	70
Subtotal		59	767	673	1,090	1,250	1,253	2,040	3,465
True Hemp Woven Fabrics (HS 5311004010)	m2 (1000)	435	920	478	263	284	270	319	224

Source: Compiled by CRS using data from the U.S. International Trade Commission, <http://dataweb.usitc.gov>. Data are by Harmonized System (HS) code. Data shown as “—” indicate data are not available as breakout categories or, for some product subcategories, were established only recently.

- a. Data for 2007-2011 were supplemented by reported Canadian export data for hemp seeds (HS 12079910, hemp seeds, whether or not broken) as reported by Global Trade Atlas, <http://www.gtis.com/gta/>. Official U.S. trade data reported no imports during these years for these HS subcategories. The Canadian export data as reported by Global Trade Atlas also differ for hemp seed oilcake (15159020, hemp oil and its fractions, whether or not refined but not chemically modified) but were not similarly substituted since other countries exported product to the United States.

Similarly, the UW-M study concluded that hemp production “is not likely to generate sizeable profits,” and, although hemp may be “slightly more profitable than traditional row crops,” it is likely “less profitable than other specialty crops” due to the “current state of harvesting and processing technologies, which are quite labor intensive, and result in relatively high per unit costs.”²⁶ The study highlights that U.S. hemp growers could be affected by competition from other world producers and by certain production limitations in the United States, including yield variability and lack of harvesting innovations and processing facilities in the United States, as well as difficulty transporting bulk hemp. The study further claims that most estimates of profitability from hemp production are highly speculative and often do not include additional costs of growing hemp in a regulated market, such as the cost associated with “licensing, monitoring, and verification of commercial hemp.”²⁷

A 2013 study by researchers at the University of Kentucky highlights some of the issues and challenges for that state’s growers, processors, and industry. The study predicts that in Kentucky, despite “showing some positive returns, under current market conditions, it does not appear that anticipated hemp returns will be large enough to entice Kentucky grain growers to shift out of grain production,” under most circumstances; also, “short run employment opportunities evolving from a new Kentucky hemp industry appear limited (perhaps dozens of new jobs, not 100s),” because of continued uncertainty in the industry.²⁸ Overall, the study concludes that there are many remaining unknowns and further analysis and production research is needed.

Given the absence since the 1950s of any commercial and unrestricted hemp production in the United States, it is not possible to predict the potential market and employment effects of relaxing current restrictions on U.S. hemp production. While expanded market opportunities might exist in some states or localities if current restrictions on production are lifted, it is not possible to predict the potential for future retail sales or employment gains in the United States, either nationally or within certain states or regions. Limited information is available from previous market analyses that have been conducted by researchers at USDA and land grant universities and state agencies.²⁹

Global Production

International Production

Approximately 30 countries in Europe, Asia, and North and South America currently permit farmers to grow hemp. Some of these countries never outlawed production, while some countries banned production for certain periods in the past. China is among the largest producing and exporting countries of hemp textiles and related products, as well as a major supplier of these products to the United States. The European Union (EU) has an active hemp market, with production in most member nations. Production is centered in France, the United Kingdom, Romania, and Hungary.³⁰

²⁶ T. R. Fortenbery and M. Bennett, “Opportunities for Commercial Hemp Production,” *Review of Agricultural Economics*, vol. 26, no. 1 (2004), pp. 97-117.

²⁷ Ibid.

²⁸ University of Kentucky, Department of Agricultural Economics, *Economic Considerations for Growing Industrial Hemp: Implications for Kentucky’s Farmers and Agricultural Economy*, July 2013.

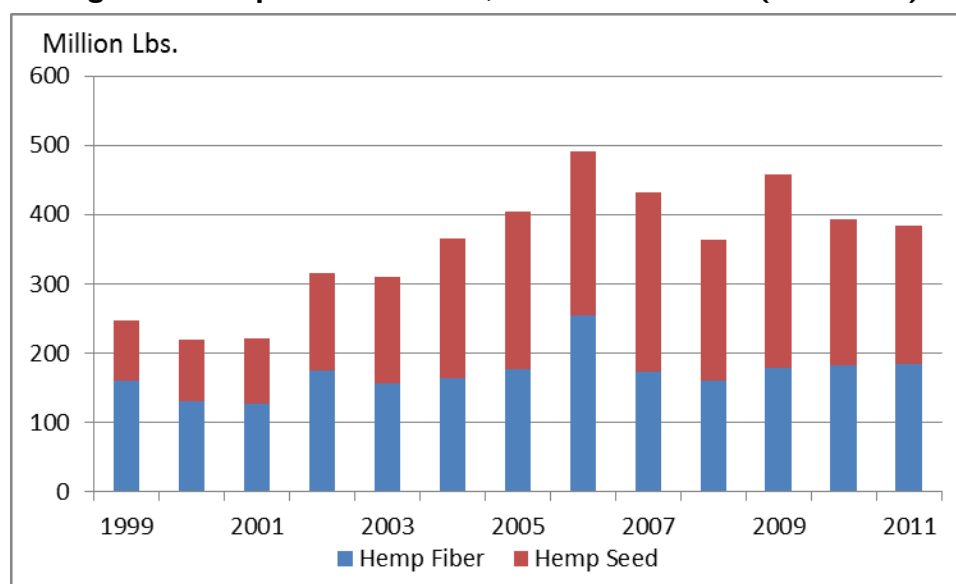
²⁹ For more information, see CRS Congressional Distribution Memorandum, “Potential U.S. Market Effects of Removing Restrictions on Growing Industrial Hemp,” March 4, 2013, available from (name redacted) (7....).

³⁰ Other EU producing countries include Austria, Denmark, Finland, Germany, Italy, Netherlands, Poland, Portugal, Slovenia, and Spain.

Acreage in hemp cultivation worldwide has been mostly flat to decreasing, reported at about 200,000 acres globally in 2011.³¹ Although variable year to year, global production has increased overall from about 250 million pounds in 1999 to more than 380 million pounds in 2011, mostly due to increasing production of hemp seed (**Figure 3**). Upward trends in global hemp seed production roughly track similar upward trends in U.S. imports of hemp seed and oil, mostly for use in hemp-based foods, supplements, and body care products (**Table 1**).

Many EU countries lifted their bans on hemp production in the 1990s and, until recently, also subsidized the production of “flax and hemp” under the EU’s Common Agricultural Policy.³² EU hemp acreage was reported at about 26,000 acres in 2010, which was below previous years, when more than 50,000 acres of hemp were under production.³³ Most EU production is of hurds, seeds, and fibers. Other non-EU European countries with reported hemp production include Russia, Ukraine, and Switzerland. Other countries with active hemp grower and/or consumer markets are Australia, New Zealand, India, Japan, Korea, Turkey, Egypt, Chile, and Thailand.

Figure 3. Hemp Fiber and Seed, Global Production (1999-2011)



Source: FAOSTAT, <http://faostat.fao.org/site/567/default.aspx#ancor>.

Canada is another major supplier of U.S. imports, particularly of hemp-based foods and related imported products. Canada’s commercial hemp industry is fairly new: Canada began to issue licenses for research crops in 1994, followed by commercial licenses starting in 1998.

The development of Canada’s hemp market followed a 60-year prohibition and is strictly regulated.³⁴ Its program is administered by the Office of Controlled Substances of Health Canada, which issues licenses for all activities involving hemp. Under the regulation, all industrial hemp grown, processed, and sold in Canada may contain THC levels no more than 0.3% of the weight

³¹ Food and Agriculture Organization (FAO) of the United Nations, FAOSTAT crop data, <http://faostat.fao.org/>.

³² For information on the EU’s prior agricultural support for industrial hemp, see the EU’s notification to the World Trade Organization regarding its domestic support for agricultural producers (G/AG/N/EEC/68; January 24, 2011).

³³ M. Carus et al., “The European Hemp Industry,” May 2013. Also see European Industrial Hemp Association, “European Commission: Hemp and Flax, AGRI C5, 2009,” February 2009.

³⁴ Industrial Hemp Regulations (SOR/98-156), as part of the Controlled Drugs and Substances Act.

of leaves and flowering parts. Canada also has set a maximum level of 10 parts per million (ppm) for THC residues in products derived from hemp grain, such as flour and oil.³⁵ To obtain a license to grow hemp, Canadian farmers must submit extensive documentation, including background criminal record checks, the Global Positioning System (GPS) coordinates of their fields, and supporting documents (from the Canadian Seed Growers' Association or the Canadian Food Inspection Agency) regarding their use of low-THC hemp seeds and approved cultivars; and they must allow government testing of their crop for THC levels.³⁶ Since hemp cultivation was legalized in Canada, production has been variable year to year (**Figure 4**), ranging from a high of 48,000 acres planted in 2006, to about 4,000 acres in 2001-2002, to a reported nearly 39,000 acres in 2011. Canada's hemp cultivation still accounts for less than 1% of the country's available farmland. The number of cultivation licenses has also varied from year to year, reaching a high of 560 licenses in 2006, followed by a low of 77 licenses in 2008 (with 340 licenses in 2011).³⁷

Historical U.S. Production

Hemp was widely grown in the United States from the colonial period into the mid-1800s; fine and coarse fabrics, twine, and paper from hemp were in common use. By the 1890s, labor-saving machinery for harvesting cotton made the latter more competitive as a source of fabric for clothing, and the demand for coarse natural fibers was met increasingly by imports. Industrial hemp was handled in the same way as any other farm commodity, in that USDA compiled statistics and published crop reports,³⁸ and provided assistance to farmers promoting production and distribution.³⁹ In the early 1900s, hemp continued to be grown and researchers at USDA continued to publish information related to hemp production and also reported on hemp's potential for use in textiles and in paper manufacturing.⁴⁰ Several hemp advocacy groups, including the Hemp Industries Association (HIA) and Vote Hemp Inc., have compiled other historical information and have copies of original source documents.⁴¹

Between 1914 and 1933, in an effort to stem the use of *Cannabis* flowers and leaves for their psychotropic effects, 33 states passed laws restricting legal production to medicinal and industrial purposes only.⁴² The 1937 Marihuana Tax Act defined hemp as a narcotic drug, requiring that farmers growing hemp hold a federal registration and special tax stamp, effectively limiting further production expansion.

In 1943, U.S. hemp production reached more than 150 million pounds (140.7 million pounds hemp fiber; 10.7 million pound hemp seed) on 146,200 harvested acres. This compared to pre-

³⁵ Agriculture Canada, "Canada's Industrial Hemp Industry," March 2007, <http://www4.agr.gc.ca>.

³⁶ See Health Canada's FAQs on its hemp regulations and its application for obtaining permits (<http://www.hc-sc.gc.ca/>). Other information is at the Canadian Food Inspection Agency website (<http://www.inspection.gc.ca/>).

³⁷ Health Canada, Industrial Hemp Section, "Cultivation Licenses," October 25, 2011.

³⁸ See, for example, editions of USDA *Agricultural Statistics*. A compilation of U.S. government publications is available from the Hemp Industries Association (HIA) at <http://www.hempology.org/ALLARTICLES.html>.

³⁹ See, for example, USDA's 1942 short film "Hemp for Victory" and University of Wisconsin's Extension Service Special Circular, "What About Growing Hemp," November 1942.

⁴⁰ Regarding papermaking, see L. H. Dewey and J. L. Merrill, "Hemp Hurds as Paper-Making Material," USDA Bulletin No. 404, October 14, 1916. A copy of this document is available, as posted by Vote Hemp Inc., at <http://www.votehemp.com/17855-h/17855-h.htm>. Other USDA and state documents from this period are available at <http://www.hempology.org/ALLARTICLES.html>.

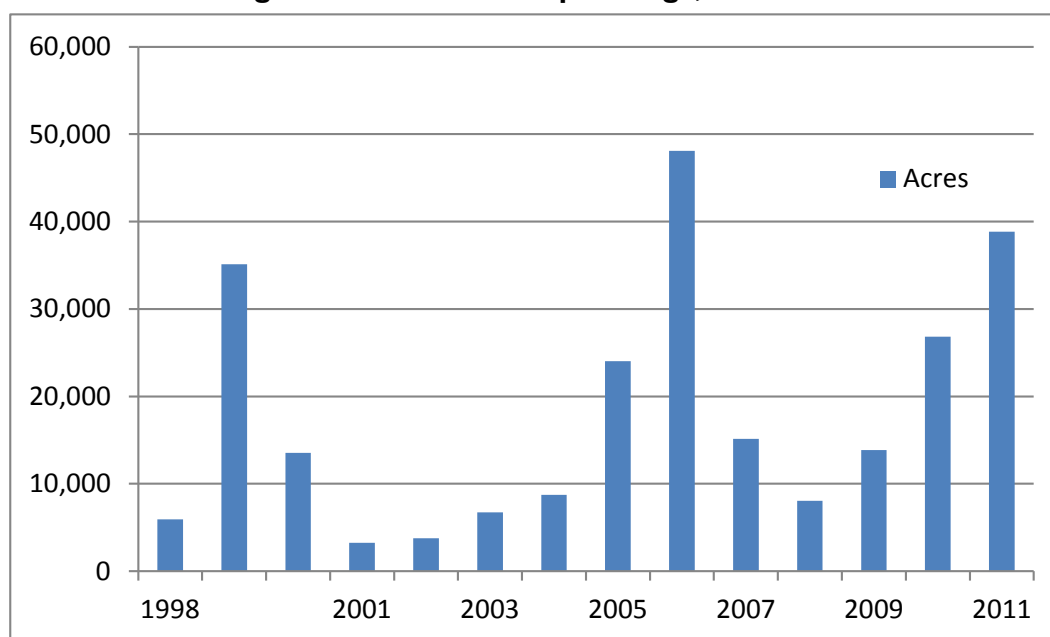
⁴¹ See links at <http://www.thehia.org/history.html> and <http://www.hemphistoryweek.com/timeline.html>.

⁴² R. J. Bonnie and C. H. Whitebread, *The Marihuana Conviction: A History of Marihuana Prohibition in the United States* (Charlottesville: University Press of Virginia, 1974), p. 51.

war production levels of about 1 million pounds. After reaching a peak in 1943, production started to decline. By 1948, production had dropped back to 3 million pounds on 2,800 harvested acres, with no recorded production after the late 1950s.⁴³

Currently, industrial hemp is not grown commercially in the United States. No active federal licenses allow U.S. commercial cultivation at this time.

Figure 4. Canadian Hemp Acreage, 1998-2011



Source: Agriculture and Agri-Food Canada, "Industrial Hemp Statistics," <http://www4.agr.gc.ca/AAFC-AAC/display-afficher.do?id=1174420265572&lang=eng>.

Note: The downturn in 2007 is viewed as a correction of overproduction in 2006, following the "success of the court case against the DEA in 2004, and continued improvements in breeding, production, and processing," which resulted in part in a "dramatic reduction in hemp acreage planted" in 2007. The 2007 downturn is also attributed to "increasingly positive economics of growing other crops" (Manitoba Agriculture, National Industrial Hemp Strategy, March 2008, prepared for Food and Rural Initiative Agriculture and Agri-Food Canada).

Legal Status in the United States

Federal Law and Requirements

Controlled Substances Act of 1970

In 1937, Congress passed the first federal law to discourage cannabis production for marijuana while still permitting industrial uses of the crop (the Marihuana Tax Act; 50 Stat. 551). Under this statute, the government actively encouraged farmers to grow hemp for fiber and oil during World War II. After the war, competition from synthetic fibers, the Marihuana Tax Act, and increasing

⁴³ USDA *Agricultural Statistics*, various years through 1949. A summary of data spanning 1931-1945 is available in the 1946 edition. See "Table 391—Hemp Fiber and Hempseed: Acreage, Yield, and Production, United States."

public anti-drug sentiment resulted in fewer and fewer acres of hemp being planted, and none at all after 1958.

Strictly speaking, the Controlled Substances Act of 1970 (CSA, 21 U.S.C. §801 *et. seq.*) does not make growing hemp illegal; rather, it places strict controls on the production of hemp, making it illegal to grow the crop without a DEA permit.

The CSA adopted the same definition of *Cannabis sativa* that appeared in the 1937 Marihuana Tax Act. The definition of “marihuana” (21 U.S.C. §802(16)) reads:

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. Such term does 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 ... 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.

The statute thus retains control over all varieties of the cannabis plant by virtue of including them under the term “marijuana” and does not distinguish between low- and high-THC varieties. The language exempts from control the parts of mature plants—stalks, fiber, oil, cake, etc.—intended for industrial uses. Some have argued that the CSA definition exempts industrial hemp under its term exclusions for stalks, fiber, oil and cake, and seeds.⁴⁴ DEA refutes this interpretation.⁴⁵

DEA Permit Requirements

Federal law prohibits cultivation without a permit, DEA determines whether any industrial hemp production authorized under a state statute is permitted, and it enforces standards governing the security conditions under which the crop must be grown. In other words, a grower needs to get permission from the DEA to grow hemp or faces the possibility of federal charges or property confiscation, regardless of whether the grower has a state-issued permit.⁴⁶

Although many states have established programs under which a farmer may be able to grow industrial hemp under certain circumstances, a grower would still need to obtain a DEA permit and abide by the DEA’s strict production controls. This relationship has resulted in some high-profile cases, wherein growers have applied for a permit but DEA has not approved (or denied) a permit to grow hemp, even in states that authorize cultivation under state laws.

In the past there has been ongoing tension between federal and state authorities over state hemp policies. After passing its own state law authorizing industrial hemp production in 1999,⁴⁷ researchers in North Dakota repeatedly applied for, but did not receive, a DEA permit to cultivate hemp for research purposes in the state.⁴⁸ Also in 2007, two North Dakota farmers were granted state hemp farming licenses and, in June 2007, filed a lawsuit in U.S. District Court (North Dakota) seeking “a declaratory judgment” that the CSA “does not prohibit their cultivation of

⁴⁴ See, for example, *Hemp Industries Association v. Drug Enforcement Administration*, 357 F.2d (9th Circuit 2004).

⁴⁵ 66 *Federal Register* 51530, October 9, 2001.

⁴⁶ Registration requirements are at 21 C.F.R. 823. See also DEA’s registration procedures and applications at <http://www.deadiversion.usdoj.gov/drugreg/process.htm>.

⁴⁷ The North Dakota Department of Agriculture issued final regulations in 2007 on licensing hemp production. For information on the state’s requirements, see <http://www.agdepartment.com/Programs/Plant/HempFarming.htm>.

⁴⁸ See, for example, letter from North Dakota State University to the DEA, July 27, 2007.

industrial hemp pursuant to their state licenses.”⁴⁹ The case was dismissed in November 2007.⁵⁰ The case was appealed to the U.S. Court of Appeals (8th Circuit) but was again dismissed in December 2009.⁵¹ They filed an appeal in May 2010.⁵²

Even if DEA were to approve a permit, it could be argued that production might be limited or discouraged because of the perceived difficulties of working through DEA licensing requirements and installing the types of structures necessary to obtain a permit. Obtaining a DEA permit to produce hemp requires that the applicant demonstrate that an effective security protocol will be in place at the production site, such as security fencing around the planting area, a 24-hour monitoring system, controlled access, and possibly armed guard(s) to prevent public access.⁵³ DEA application requirements also include a nonrefundable fee, FBI background checks, and extensive documentation. It could also be argued that, because of the necessary time-consuming steps involved in obtaining and operating under a DEA permit, the additional management and production costs from installing structures, as well as other business and regulatory requirements, could ultimately limit the operation’s profitability.

To date, all commercial hemp products sold in the United States are imported or manufactured from imported hemp materials. Most reports have been indicating that the DEA has not granted any current licenses to grow hemp, even for research purposes.⁵⁴ Previously reports indicated the DEA had issued a permit for an experimental quarter-acre plot at the Hawaii Industrial Hemp Research Program during the period from 1999 to 2003 (now expired).⁵⁵ In recent years, attempts to grow hemp under state law have been reported in North Dakota, Montana, Vermont, and other states. For example, in May 2013, it was reported that hemp was being cultivated in Colorado, following changes to that state’s laws in November 2012. Similarly, Montana passed its state law authorizing hemp production in 2001. In October 2009, Montana’s Agriculture Department issued its first state license for an industrial hemp-growing operation in the state. Media reports indicated that the grower did not intend to request a federal permit.⁵⁶ Such cases have posed a challenge to DEA of whether it is willing to override the state’s authority to allow for hemp production in the state, as well as a test of state’s rights.

Most reports indicate that the DEA continues to be reluctant to grant licenses to grow hemp, even for research purposes.⁵⁷ However, more recently, there are indications that some land grant university researchers may have been granted licenses to conduct hemp research under certain conditions.⁵⁸

⁴⁹ David Monson and Wayne Hauge v. Drug Enforcement Administration and United States Department of Justice, Complaint for Declaratory Judgment, U.S. District Court for the District of North Dakota, June 18, 2007. For an overview, see Vote Hemp Inc. website: http://www.votehemp.com/legal_cases_ND.html#overview.

⁵⁰ Monson v. DEA, 522 F. Supp. 2d 1188 (D.N.D. 2007).

⁵¹ Monson v. DEA, 589 F.3d 952 (8th Cir. 2009).

⁵² S. Roesler, “ND Farmers File Another Industrial Hemp Appeal in District Court,” *Farm & Ranch Guide*, June 4, 2010.

⁵³ University of Kentucky Cooperative Extension Service, “Industrial Hemp—Legal Issues,” September 2012.

⁵⁴ S. Raabe, “First Major Hemp Crop in 60 Years Is Planted in Southeast Colorado,” *Denverpost.com*, May 13, 2013.

⁵⁵ DEA, “Statement from the Drug Enforcement Administration on the Industrial Use of Hemp,” March 12, 1998.

⁵⁶ M. Brown, “First License Issued to Montana Hemp Grower,” *Missoulian*, October 27, 2009.

⁵⁷ S. Raabe, “First Major Hemp Crop in 60 Years Is Planted in Southeast Colorado,” *Denverpost.com*, May 13, 2013.

⁵⁸ See, for example, B. Bakst, “Minnesota to Go Slow on Industrial Hemp Pilot Project, Frustrating Farmers Eager to Grow Crop,” *Star Tribune*, August 8, 2015.

Other DEA Policy Statements

Other DEA documentation illustrates how DEA has reviewed inquiries about the legal status of hemp-based products (such as those shown in **Figure 2**), including inquiries from U.S. Customs inspectors regarding the need for guidance regarding imported hemp products.⁵⁹

DEA took the position that it would follow the plain language of the Controlled Substances Act (CSA), which expressly states that anything that contains “any quantity” of marijuana or THC is a schedule I controlled substance. However, as a reasonable accommodation, DEA exempted from control legitimate industrial products that contained THC but were not intended for human consumption (such as clothing, paper, and animal feed).

DEA’s position that “anything that contains ‘any quantity’ of marijuana or THC” should be regarded as a controlled substance is further supported by reports published by the National Institute on Drug Abuse (NIDA), which is part of the National Institutes of Health. Although NIDA does not have a formal position about industrial hemp, NIDA’s research tends to conflate all cannabis varieties, including marijuana and hemp. For example, NIDA reports: “All forms of marijuana are mind-altering (psychoactive)” and “they all contain THC (delta-9-tetrahydrocannabinol), the main active chemical in marijuana.”⁶⁰ The DEA further maintains that the CSA does not differentiate between different varieties of cannabis based on THC content.⁶¹

Regarding DEA’s issuance of its 2003 rules and the import dispute that followed (discussed in the previous report sections), the agency continues to maintain that the courts have expressed conflicting opinions on these issues:⁶²

Despite the plain language of the statute supporting DEA’s position, the ninth circuit ruled in 2004 that the DEA rules were impermissible under the statute and therefore ordered DEA to refrain from enforcing them. Subsequently, in 2006, another federal court of appeals (the eight circuit) took a different view, stating, as DEA had said in its rules: “The plain language of the CSA states that schedule I(c) includes ‘any material ... which contains any quantity of THC’ and thus such material is regulated.”...⁶³ Thus, the federal courts have expressed conflicting views regarding the legal status of cannabis derivatives.

Regarding interest among growers in some states to cultivate hemp for industrial use, DEA claims that the courts have supported the agency’s current policy that all hemp growers—regardless of whether a state permit has been issued and of the THC content—are subject to the CSA and must obtain a federal permit:⁶⁴

Under the CSA, anyone who seeks to grow marijuana for any purpose must first obtain a DEA registration authorizing such activity. However, several persons have claimed that growing marijuana to produce so-called “hemp” (which purportedly contains a relatively low percentage of THC) is not subject to CSA control and requires no DEA registration. All such claims have thus far failed, as every federal court that has addressed the issue has ruled that any person who seeks to grow any form of marijuana (no matter the THC content or the purpose for which it is grown) must obtain a DEA registration.

⁵⁹ DEA, “DEA History in Depth,” 1999-2003, and other DEA published resources.

⁶⁰ NIDA, “Marijuana: Facts for Teens,” <http://www.drugabuse.gov/publications/marijuana-facts-teens/letter-to-teens>.

⁶¹ DEA, “DEA History in Depth,” 1999-2003, and other DEA published resources.

⁶² Ibid.

⁶³ DEA-cited court case: *United States v. White Plume*, 447 F.3d 1067, 1073 (8th Cir. 2006).

⁶⁴ DEA, “DEA History in Depth,” 1999-2003, and other DEA published resources. DEA-cited court cases: *New Hampshire Hemp Council, Inc. v. Marshall*, 203 F.3d 1 (1st Cir 2000); *United States v. White Plume*, supra; *Monson v. DEA*, 522 F.Supp.2d 1188 (D. N.D. 2007), No. 07-3837 (8th Cir. 2007).

Regarding states that have enacted laws legalizing cannabis grown for industrial purposes, “these laws conflict with the CSA, which does not differentiate, for control purposes, between marijuana of relatively low THC content and marijuana of greater THC content.”⁶⁵

Dispute over Hemp Food Imports (1999-2004)

Starting in late 1999, the DEA acted administratively to demand that the U.S. Customs Service enforce a zero-tolerance standard for the THC content of all forms of imported hemp, and hemp foods in particular. Development of DEA’s rules to support its actions sparked a fierce battle over the permissibility of imported hemp-based food products that lasted from 1999 until 2004.

The DEA followed up, in October 2001, with publication of an interpretive rule in the *Federal Register* explaining the basis of its zero-tolerance standard.⁶⁶ It held that when Congress wrote the statutory definition of marijuana in 1937, it “exempted certain portions of the *Cannabis* plant from the definition of marijuana based on the assumption (now refuted) that such portions of the plant contain none of the psychoactive component now known as THC.”

In March 2003, DEA issued two final rules addressing the legal status of hemp products derived from the cannabis plant. The DEA found that hemp products “often contain the hallucinogenic substance tetrahydrocannabinols (THC) ... the primary psychoactive chemical found in the cannabis (marijuana) plant.”⁶⁷ Although the DEA acknowledged that “in some cases, a Schedule I controlled substance may have a legitimate industrial use,” such use would only be allowed under highly controlled circumstances. These rules set forth what products may contain “hemp” and also prohibit “cannabis products containing THC that are intended or used for human consumption (foods and beverages).”⁶⁸

Both the proposed rule (which was published concurrently with the interpretive rule) and the final 2003 rule gave retailers of hemp foods a date after which the DEA could seize all such products remaining on shelves. On both rules, hemp trade associations requested and received court-ordered stays blocking enforcement of that provision. The DEA’s interpretation made hemp with any THC content subject to enforcement as a controlled substance.

Hemp industry trade groups, retailers, and a major Canadian exporter filed suit against the DEA, arguing that congressional intent was to exempt plant parts containing naturally occurring THC at non-psychoactive levels, the same way it exempts poppy seeds containing trace amounts of naturally occurring opiates.⁶⁹ Industry groups maintain that (1) naturally occurring THC in the leaves and flowers of cannabis varieties grown for fiber and food is already at below-psychoactive levels (compared with drug varieties); (2) the parts used for food purposes (seeds and oil) contain even less; and (3) after processing, the THC content is at or close to zero. U.S. and Canadian hemp seed and food manufacturers have in place a voluntary program for certifying low, industry-determined standards in hemp-containing foods. Background information on the TestPledge Program is available at <http://www.TestPledge.com>. The intent of the program is to assure that consumption of hemp foods will not interfere with workplace drug testing programs or produce undesirable mental or physical health effects.

⁶⁵ DEA, “DEA History in Depth,” 1999-2003, and other DEA published resources.

⁶⁶ 66 *Federal Register* 51530, October 9, 2001.

⁶⁷ DEA, “DEA History in Depth,” 1999-2003, and other DEA published resources.

⁶⁸ *Ibid.*

⁶⁹ 21 U.S.C. §802 (19) and (20).

On February 6, 2004, the U.S. Court of Appeals for the Ninth Circuit permanently enjoined the enforcement of the final rule.⁷⁰ The court stated that “the DEA’s definition of ‘THC’ contravenes the unambiguously expressed intent of Congress in the CSA and cannot be upheld.”⁷¹ In late September 2004 the Bush Administration let the final deadline pass without filing an appeal.

2013 DEA Guidance Outlined in “Cole Memo”

In August 2013, the Department of Justice (DOJ) updated its federal marijuana enforcement policy following 2012 state ballot initiatives in Washington and Colorado that “legalized, under state law, the possession of small amounts of marijuana and provide for the regulation of marijuana production, processing, and sale.”⁷² The guidance—commonly referred to as the “Cole memo”—outlines DOJ’s policy, clarifying that “marijuana remains an illegal drug under the Controlled Substances Act and that federal prosecutors will continue to aggressively enforce this statute.” DOJ identified eight enforcement areas that federal prosecutors should prioritize.

These include:⁷³

- preventing the distribution of marijuana to minors;
- preventing revenue from the sale of marijuana from going to criminal enterprises, gangs, and cartels;
- preventing the diversion of marijuana from states where it is legal under state law in some form to other states;
- preventing state-authorized marijuana activity from being used as a cover or pretext for the trafficking of other illegal drugs or other illegal activity;
- preventing violence and the use of firearms in the cultivation and distribution of marijuana;
- preventing drugged driving and the exacerbation of other adverse public health consequences associated with marijuana use;
- preventing the growing of marijuana on public lands and the attendant public safety and environmental dangers posed by marijuana production on public lands; and
- preventing marijuana possession or use on federal property.

Although the Cole memo does not specifically address industrial hemp, because DOJ regards all varieties of the cannabis plant as “marijuana” and does not distinguish between low- and high-THC varieties, the August 2013 guidance appears to cover industrial hemp production as well. Accordingly, some are interpreting the guidance as allowing states to proceed to implement their laws regulating and authorizing the cultivation of hemp.⁷⁴

In addition, although many states have established programs under which a farmer may be able to grow industrial hemp under certain circumstances (see “State Laws”), a grower still needs to obtain a DEA permit and abide by the DEA’s strict production controls. For example, changes to

⁷⁰ 68 *Federal Register* 14113, March 21, 2003.

⁷¹ *Hemp Industries Association v. Drug Enforcement Administration*, 357 F.2d (9th Circuit 2004).

⁷² Letter providing guidance regarding marijuana enforcement from Deputy U.S. Attorney General James Cole to all U.S. States Attorneys, August 29, 2013, <http://www.justice.gov/opa/pr/2013/August/13-opa-974.html>.

⁷³ *Ibid.*

⁷⁴ Letter to interested parties from Joe Sandler, counsel for Vote Hemp, November 13, 2013.

Colorado's state laws in November 2012 now allow for industrial hemp cultivation. Industrial hemp was reported as being grown in Colorado in 2013.⁷⁵ However, growers and state authorities continue to face a number of challenges implementing Colorado's law, including sampling, registration and inspection, seed availability and sourcing, disposition of non-complying plants, and law enforcement concerns, as well as production issues such as hemp agronomics, costly equipment, and limited manufacturing capacity, among other grower and processor concerns.⁷⁶ It remains unclear how federal authorities will respond to production in states where state laws permit growing and cultivating hemp.

In November 2012, state authorities in Colorado wrote a letter to DOJ requesting clarification about how federal enforcement authorities might respond to its newly enacted laws and forthcoming regulations.⁷⁷ Since federal law regards all varieties of the cannabis plant as "marijuana," many continue to regard DOJ's August 2013 guidance as also likely applicable to the regulation of industrial hemp.⁷⁸ In November 2013, Colorado's State Department of Agriculture officials further contacted USDA requesting clarification regarding the cultivation of industrial hemp specifically.⁷⁹ It is not known whether either federal agency has responded to the state's requests.

In September 2013, Representative Blumenauer sent a letter to Oregon state officials urging them to implement that state's hemp laws.⁸⁰ In response, DOJ officials in Oregon reiterated that since "'industrial hemp' is marijuana, under the CSA, these eight enforcement priorities apply to hemp just as they do for all forms of cannabis" and that "federal prosecutors will remain aggressive" when it comes to protecting these eight priorities.⁸¹ They further indicated that they do not intend to interfere with their state's hemp production as long as it is well-regulated and subject to enforcement.⁸² Some now regard that correspondence as further indicative of how federal authorities might respond to production in states where state laws permit growing and cultivating hemp.⁸³

DEA's Blocking of Imported Viable Hemp Seeds

In response to the enactment of the 2014 farm bill provision allowing for the cultivation of industrial hemp by research institutions and state departments of agriculture (see "2014 Farm Bill"), several states made immediate plans to initiate new hemp pilot projects.

⁷⁵ S. Raabe, "First Major Hemp Crop in 60 Years Is Planted in Southeast Colorado," *Denverpost.com*, May 13, 2013; also see E. Hunter, "Industrial Hemp in Colorado," November 17, 2013 (presentation at the 2013 HIA conference).

⁷⁶ R. Carleton, "Regulating Industrial Hemp: The Colorado Experience," February 3, 2013 (presentation at the 2014 National Association of State Department of Agriculture [NASDA] winter meeting); and E. Hunter, "Industrial Hemp in Colorado," November 17, 2013 (presentation at the 2013 HIA conference).

⁷⁷ Letter to Eric Holder, Jr., U.S. Attorney General, from the governor and attorney general of the state of Colorado, November 13, 2012.

⁷⁸ Letter to interested parties from Joe Sandler, counsel for Vote Hemp, November 13, 2013.

⁷⁹ Letter to Tom Vilsack, Secretary of Agriculture, from the commissioner of the Colorado Department of Agriculture, November 13, 2013.

⁸⁰ Letter from Rep. Earl Blumenauer to Oregon Department of Agriculture and State Board of Agriculture officials, September 17, 2013.

⁸¹ Letter to Rep. Earl Blumenauer, from S. Amanda Marshall, U.S. Attorney, District of Oregon, November 7, 2013.

⁸² Ibid. See also N. Crombie, "U.S. Rep. Earl Blumenauer Urges Oregon to Implement Industrial Hemp Law," *The Oregonian*, September 18, 2013.

⁸³ CRS communication with representatives of Vote Hemp, Inc., January 2014.

For example, the State of Kentucky announced plans for several pilot projects through the Kentucky Department of Agriculture.⁸⁴ However, in May 2014, the department's shipment of 250 pounds of imported *viable* hemp seed from Italy was blocked by U.S. Customs officials at Louisville International Airport. DEA officials contend the action was warranted since the "importation of cannabis seeds continues to be subject to the Controlled Substances Imports and Export Act (CSIEA)"⁸⁵ and to the implementing regulations, which restrict persons from importing *viable* cannabis seed unless the person is registered with DEA and has obtained the necessary Schedule I research permit, among other requirements.

Viable seeds refer to seeds that are alive and have the potential to germinate and develop into normal reproductively mature plants, under appropriate growing conditions. The DEA has required that seeds be either heat sterilized or steam sterilized to remove any naturally occurring traces of THC, which makes the seeds mostly incapable of germination. The importation, sterilization, and commercial distribution of hemp seed is regulated by the DEA pursuant to CSIEA (21 U.S.C. 951 et. seq. and 21 C.F.R. 1311).

To facilitate release of the hemp seeds, the Kentucky Department of Agriculture filed a lawsuit in U.S. District Court against the DEA, the Justice Department, U.S. Customs and Border Protection (CBP), and the U.S. Attorney General.⁸⁶ In the lawsuit, the department contends that its efforts to grow industrial hemp are authorized under both state and federal law, and that the DEA should not seek to impose "additional requirements, restrictions, and prohibitions" on hemp production beyond requirements in the 2014 farm bill, or otherwise interfere with its delivery of hemp seeds.

Although Kentucky's seeds were eventually released and planted,⁸⁷ these circumstances have resulted in uncertainty for U.S. hemp growers. In response, Congress enacted additional legislation to stop DEA from taking similar actions in the future. (See discussion in "FY2015 and FY2016 Appropriations.")

Other Federal Actions Involving USDA

In 1994, President Clinton issued Executive Order 12919, entitled "National Defense Industrial Resources Preparedness," which was intended to strengthen the U.S. industrial and technology base for meeting national defense requirements. The order included hemp among the essential agricultural products that should be stocked for defense preparedness purposes.⁸⁸ Some hemp supporters have argued that the executive order gives hemp a renewed value as a strategic crop for national security purposes, in line with its role in World War II.⁸⁹

⁸⁴ See, for example, Kentucky Department of Agriculture, "Industrial Hemp Program," <http://www.kyagr.com/marketing/hemp-pilot.html>.

⁸⁵ 21 U.S.C. §§951-971. Letter from Joseph T. Rannazzisi, Deputy Assistant Administrator, DEA Office of Diversion Control, to Luke Morgan, counsel for Kentucky Department of Agriculture, May 13, 2014.

⁸⁶ Kentucky Department of Agriculture v. U.S. Drug Enforcement Agency, U.S. Customs and Border Protection, U.S. Justice Department, and Eric Holder (Western District of Kentucky, Louisville Division), May 2014, <http://media.kentucky.com/smedia/2014/05/14/16/44/X9Fs3.So.79.pdf>.

⁸⁷ J. Patton, "Hemp Seeds Planted in Central Kentucky for First Time in Decades," *Lexington Herald-Ledger*, May 27, 2014.

⁸⁸ Hemp is included under the category of "food resources," which is defined to mean, in part, "all starches, sugars, vegetable and animal or marine fats and oils, cotton, tobacco, wool, mohair, hemp, flax, fiber and other materials, but not any such material after it loses its identity as an agricultural commodity or product."

⁸⁹ J. B. Kahn, "Hemp ... Why Not?" Berkeley Electronic Press (bepress) Legal Series, Paper 1930, 2007.

USDA has supported research on alternative crops and industrial uses of common commodities since the late 1930s. Some alternative crops have become established in certain parts of the United States—kenaf (for fiber) in Texas, jojoba (for oil) in Arizona and California, and amaranth (for nutritious grain) in the Great Plains states. Many have benefits similar to those ascribed to hemp, but are not complicated by having a psychotropic variety within the same species.

The Critical Agricultural Materials Act of 1984 (P.L. 98-284, 7 U.S.C. §178) supports the supplemental and alternative crops provisions of the 1985 and 1990 omnibus farm acts and other authorities, and funds research and development on alternative crops at USDA and state laboratories. In 2010, USDA recommended \$1.083 million for programs under the act.⁹⁰ In addition, Section 1473D of the National Agricultural Research, Extension, and Teaching Policy Act of 1977 (7 U.S.C. §3319d(c)) authorizes USDA to make competitive grants toward the development of new commercial products derived from natural plant material for industrial, medical, and agricultural applications.⁹¹ In 2010, USDA recommended \$835,000 for the program.⁹² To date, these authorities have not been used to develop hemp cultivation and use.

The United States is a signatory of the United Nations Single Convention on Narcotic Drugs, 1961 (as amended by the 1972 Protocol Amending the Single Convention on Narcotic Drugs, 1961).⁹³ The principal objectives of the convention are to “limit the possession, use, trade in, distribution, import, export, manufacture and production of drugs exclusively to medical and scientific purposes and to address drug trafficking through international cooperation to deter and discourage drug traffickers.”⁹⁴ The convention requires that each party control cannabis cultivation within its borders; however, Article 28.2 of the convention states: “This Convention shall not apply to the cultivation of the cannabis plant exclusively for industrial purposes (fibre and seed) or horticultural purposes.”⁹⁵ Thus the convention need not present an impediment to the development of a regulated hemp farming sector in the United States.

State Laws

Since the mid-1990s, there has been a resurgence of interest in the United States in producing industrial hemp. Farmers in regions of the country that are highly dependent upon a single crop, such as tobacco or wheat, have shown interest in hemp’s potential as a high-value alternative crop, although the economic studies conducted so far paint a mixed profitability picture. Beginning around 1995, an increasing number of state legislatures began to consider a variety of initiatives related to industrial hemp. Most of these have been resolutions calling for scientific, economic, or environmental studies, and some are laws authorizing planting experimental plots under state statutes. Nonetheless, the actual planting of hemp, even for state-authorized experimental purposes, remains regulated by the DEA under the Controlled Substances Act.

Following enactment of the 2014 farm bill provision allowing for growing hemp under certain circumstances, several states have quickly been adopting new state laws to allow for cultivation. To date, nearly 30 states or territories have reportedly introduced legislation favorable to hemp

⁹⁰ USDA’s 2011 Explanatory Notes, <http://www.obpa.usda.gov/17nifa2011notes.pdf>.

⁹¹ For information, see USDA, http://www.csrees.usda.gov/funding/rfas/pdfs/10_alt_crops.pdf.

⁹² See USDA’s 2011 Explanatory Notes, <http://www.obpa.usda.gov/17nifa2011notes.pdf>.

⁹³ United Nations Single Convention on Narcotic Drugs, 1961 (as amended by the 1972 Protocol Amending the Single Convention on Narcotic Drugs, 1961), Article 28.

⁹⁴ Information posted on International Narcotics Control Board website.

⁹⁵ Ibid.

Some common provisions across these state laws include:⁹⁸

- defining industrial hemp (based on the percentage of tetrahydrocannabinol it contains) and excluding industrial hemp from the definition of “controlled substances” under state law;
- authorizing the growing and possessing of industrial hemp by creating an advisory board or commission;
- establishing or authorizing a state licensing or registration program for growers and/or seed breeders;
- requiring recordkeeping;
- requiring waivers or changes to federal law;
- establishing or authorizing fee structures;
- establishing inspection procedures;
- allowing state departments to collect funds for research programs;
- promoting research and development of markets for industrial hemp;
- establishing certified seed requirements or, in some states, “heritage hemp seeds” (e.g., in Colorado, Kentucky); and
- establishing penalties.

Among the states that have enacted taxation and/or fees for industrial hemp are California, Colorado, Indiana, Kentucky, Maine, Montana, Nevada, North Dakota, Oregon, Tennessee, Vermont, and West Virginia.⁹⁹

Production of industrial hemp has been reported in Colorado, Kentucky, and Vermont. In Kentucky, a total of 121 participants (including seven universities) were approved to participate in the state’s 2015 program, representing more than 1,700 approved acres.¹⁰⁰ Reportedly, hemp may have begun to be grown in Oregon and Minnesota, with ongoing efforts to cultivate hemp also in North Dakota¹⁰¹ and Virginia.¹⁰²

Although many states have established programs under which a farmer may be able to grow industrial hemp under certain circumstances, growers still need to obtain a DEA permit and abide by the DEA’s strict production controls. (For more information, see “DEA Permit Requirements.”)

⁹⁸ Ibid. NCSL, State Industrial Hemp Statutes (<http://www.ncsl.org/research/agriculture-and-rural-development/state-industrial-hemp-statutes.aspx>).

⁹⁹ Based on information provided by Brittany Dement, State Analyst.

¹⁰⁰ “2015 KY Industrial Hemp Pilot Projects” (KYIndustrialHemp.com).

¹⁰¹ North Dakota Department of Agriculture, “Goehring Accepts Proposals for Industrial Hemp Pilot Program,” January 20, 2016, <http://www.nd.gov/ndda/news/goehring-accepts-proposals-industrial-hemp-pilot-program>.

¹⁰² Virginia Department of Agriculture and Consumer Services, “Annual Report on the Status and Progress of the Industrial Hemp Research Program,” November 1, 2015.

Farm Bill and Other Legislative Actions

2014 Farm Bill

The 113th Congress considered various changes to U.S. policies regarding industrial hemp during the omnibus farm bill debate.¹⁰³ The Agricultural Act of 2014 (“farm bill”)¹⁰⁴ provides that certain research institutions and state departments of agriculture may grow industrial hemp, as part of an agricultural pilot program, if allowed under state laws where the institution or state department of agriculture is located. The farm bill also established a statutory definition of “industrial hemp” as “the plant *Cannabis sativa* L. and any part of such plant, whether growing or not, with a delta-9 tetrahydrocannabinol concentration of not more than 0.3 percent on a dry weight basis.”¹⁰⁵ The provision was included as part of the research title of the law. The provision did not include an effective date that would suggest any kind of program rollout, and there appears to be nothing in the conference report or bill language to suggest that the states might not be able to immediately initiate action on this provision.

This provision was adopted when Representatives Polis, Massie, and Blumenauer introduced an amendment to the House version of the farm bill (H.R. 1947, the Federal Agriculture Reform and Risk Management Act of 2013) during floor debate on the bill. The amendment (H.Amdt. 208) was to allow institutions of higher education to grow or cultivate industrial hemp for the purpose of agricultural or academic research and applied to states that already permit industrial hemp growth and cultivation under state law. The amendment was adopted by the House of Representatives. Although the full House ultimately voted to reject H.R. 1947, similar language was included as part of a subsequent revised version of the House bill (H.R. 2642), which was passed by the full House.

In the Senate, Senators Wyden, McConnell, Paul, and Merkley introduced an amendment to the Senate version of the farm bill (S. 954, the Agriculture Reform, Food and Jobs Act of 2013). The amendment (S.Amdt. 952) would have amended the CSA to exclude industrial hemp from the definition of marijuana. The amendment was not adopted as part of the Senate-passed farm bill.

During conference on the House and Senate bills, the House provision was adopted with additional changes. The enacted law expands the House bill provision to allow both certain research institutions and also state departments of agriculture to grow industrial hemp, as part of an agricultural pilot program, if allowed under state laws where the institution or state department of agriculture is located.

As the farm bill did not include an effective date distinct from the date of enactment, several states responded by making immediate plans to initiate new hemp pilot projects. In addition, several states enacted legislation to allow for hemp cultivation, which is a precondition for allowances under the 2014 farm bill. (For more information on state actions, see “State Laws.”)

Some have speculated whether the industrial hemp provision in the 2014 farm bill could terminate or expire, or require reauthorization in a subsequent farm bill.¹⁰⁶ Although some

¹⁰³ For more detailed information on the farm bill, see CRS Report R43076, *The 2014 Farm Bill (P.L. 113-79): Summary and Side-by-Side*.

¹⁰⁴ P.L. 113-79, §7606 (7 U.S.C. 5940).

¹⁰⁵ P.L. 113-79 (§7606).

¹⁰⁶ See, for example, comments made during a National Agricultural Law Center webinar, “Production of Industrial Hemp in the U.S.: Overview, Status, & Legal Issue,” October 13, 2015.

individual authorizations in the farm bill specifically have provisions indicating that they expire in 2018 (such as authorized funding levels), the industrial hemp research provision in the 2014 farm bill does not have such language; furthermore, the farm bill does not contain a default sunset provision for all its authorizations. Accordingly, the industrial hemp research provision in the 2014 farm bill appears to be intended to have some degree of permanence.

FY2015 and FY2016 Appropriations Provisions

In response to actions taken by DEA to block seeds imported by some states in order to grow industrial hemp and to avoid future similar actions by DEA to stall full implementation of the hemp provision of the farm bill, Congress acted swiftly. Both the House and Senate FY2015 Commerce-Justice-Science (CJS) appropriations bills¹⁰⁷ contained provisions to block federal law enforcement authorities from interfering with state agencies and hemp growers, as well as to counter efforts to obstruct agricultural research. The enacted FY2015 appropriation blocks federal law enforcement authorities from interfering with state agencies, hemp growers, and agricultural research.¹⁰⁸ The provision states that “none of the funds made available” to the U.S. Department of Justice (DOJ) and the Drug Enforcement Agency (DEA) “may be used in contravention” of the 2014 farm bill (P.L. 113-79, §7606). Similar language is contained in the enacted FY2016 Consolidated Appropriations Act.¹⁰⁹ During both the FY2015 and FY2016 appropriations debates, the House CJS bills also included provisions that no funds be used to prevent a state from implementing its own state laws that “authorize the use, distribution, possession, or cultivation of industrial hemp” as defined in the 2014 farm bill.¹¹⁰ These provisions were not adopted.

In addition, the FY2016 appropriations for Agriculture, Rural Development, Food and Drug Administration, and Related Agencies within P.L. 114-113 includes a provision that was part of the Senate committee-reported bill¹¹¹ stating that “none of the funds made available” by the agricultural appropriation may be used “to prohibit the transportation, processing, sale, or use of industrial hemp that is grown or cultivated,”¹¹² in accordance with the 2014 farm bill provision.

Ongoing Congressional Activity

Industrial Hemp Farming Act

In the 114th Congress, the Industrial Hemp Farming Act of 2015 (Massie/H.R. 525; Wyden/S. 134) is intended to facilitate the possible commercial cultivation of industrial hemp in the United States. The bills would amend Section 102 of the Controlled Substances Act (21 U.S.C. 802(16)) to exclude “industrial hemp” and specify that the term “marijuana” does not include industrial hemp, which the bill would define based on a determination of its THC content (not more than 0.3% THC), marijuana’s primary psychoactive chemical. Such a change could remove low-THC hemp from being covered by the CSA as a controlled substance and subject to DEA regulation, thus allowing for industrial hemp to be grown and processed under some state laws. The bill

¹⁰⁷ H.R. 4660, §560; and S. 2437, §220.

¹⁰⁸ P.L. 113-235, Division B—Commerce, Justice, Science, and Related Agencies Appropriations Act, 2015, Title V, General Provisions, §539.

¹⁰⁹ P.L. 114-113, §543.

¹¹⁰ H.R. 4660, §557 (FY2015); H.R. 2578, §557 (FY2016).

¹¹¹ S. 1800, §739.

¹¹² P.L. 114-113, §763.

could grant authority to any state permitting industrial hemp production and processing to determine whether any such cannabis plants met the limit on THC concentration as set forth in the CSA. In any criminal or civil action or administrative proceeding, the state's determination may be conclusive and binding. The House and Senate bills differ in that S. 134 includes a provision that would allow states to override this determination if the U.S. Attorney General determines that the state law does not "reasonably" comply with the requirements of the proposed CSA amendments. H.R. 525 does not include this language.

The Industrial Hemp Farming Act was first introduced in the 109th Congress by former Representative Ron Paul, and was reintroduced in subsequent legislative sessions (H.R. 1831, 112th Congress; H.R. 1866, 111th Congress; H.R. 1009, 110th Congress; H.R. 3037, 109th Congress). In the 112th Congress, Senator Ron Wyden introduced S. 3501 in the Senate.¹¹³ Representative Massie introduced H.R. 525, and Senator Wyden introduced S. 359, in the 113th Congress. Some in Congress believe that industrial hemp production could result in economic and employment gains in some states and regions.¹¹⁴

Legislation Regarding Possible Medical Applications of Hemp

Two other bills introduced in the 114th Congress would amend the Controlled Substances Act (CSA) "to exclude cannabidiol and cannabidiol-rich plants from the definition of marijuana, and for other purposes." Both bills would also amend the CSA to define a "cannabidiol-rich plant" to mean "the plant *Cannabis sativa* L. and any part of such plant, whether growing or not, with a tetrahydrocannabinol concentration of not more than 0.3 percent on a dry weight basis," and so would be consistent with the statutory definition for industrial hemp. The two bills are related but are not identical. One way the two bills differ is that the House bill (Charlotte's Web Medical Access Act of 2015, H.R. 1635) would further exclude cannabidiol and cannabidiol-rich plants from being applicable to the Federal Food, Drug, and Cosmetic Act (21 U.S.C. 301 *et seq.*). This provision is not part of the Senate bill (Therapeutic Hemp Medical Access Act of 2015, S. 1333). A similar version of the House bill was introduced in the 113th Congress (Charlotte's Web Medical Hemp Act of 2014, H.R. 5226).

Cannabidiol (CBD) is a non-psychoactive compound in *Cannabis* that is low in delta-9 tetrahydrocannabinol (THC), marijuana's primary psychoactive chemical. The "Charlotte's Web" reference in the House bill refers to a high-CBD (low THC) *Cannabis* extract that has been sold as a dietary supplement and marketed as helping to address various ailments, including neuropathic pain, epilepsy, post-traumatic stress disorder, and nausea as a result of chemotherapy, and other disorders.¹¹⁵ Most of the CBD extracts currently being marketed for certain therapeutic purposes are generally formulated from strains of cannabis with THC levels higher than 0.3%, but

¹¹³ Previous versions of the bill differ. Section 3 of the 2009 bill would apply when a state has an industrial hemp regulatory scheme, whereas the 2011 bills would apply whenever state law permits "making industrial hemp," which a state might do by exempting hemp making from its controlled substance regulatory scheme. Section 3 of the 2009 bill would have afforded state officials "exclusive authority" to construe the proposed hemp exclusion from the definition of marijuana (amending 21 U.S.C. §802(16)(B)), whereas the 2011 bills would include within the proposed industrial hemp exclusion (amending 21 U.S.C. §802(57)) any industrial hemp grown or possessed in accordance with state law relating to making industrial hemp.

¹¹⁴ See, for example, B. Schreiner, "Senate Committee Approves Hemp Legislation," Associated Press, February 11, 2013; also press release of Senate Minority Leader, Mitch McConnell, "Industrialized Hemp Will Help Spur Economic Growth and Create Jobs in Kentucky," January 31, 2013.

¹¹⁵ Named after Charlotte Figi, who suffers from a rare pediatric seizure disorder and who reportedly has experienced relief from seizures with this strain of medical marijuana that is high in CBD and low in THC.

generally less than 1% THC.¹¹⁶ Some hemp-based CBD products have also been marketed as being rich in CBD and as having comparable therapeutic uses to CBD extracts, resulting in the Food and Drug Administration (FDA) issuing warning letters to several companies.¹¹⁷ For more information, see “Federal Research of Cannabidiol” below. Many agriculture-based groups continue to advocate for the need for additional research into the possible benefits and uses of industrial hemp-derived CBD.¹¹⁸

Administrative Actions Regarding Industrial Hemp Research

USDA Hemp Research Support¹¹⁹

In early 2015, a number of state and private research institutions began to question the extent to which industrial hemp initiatives were eligible for U.S. federal grant awards (both USDA and non-USDA program funds). In part this seems to have been in response to mixed messages received by some land grant universities about whether they would qualify for USDA competitive grants to do industrial hemp research, and initial indications that they would be denied such support. Some groups feared they could jeopardize eligibility for other grants if they pursued research into industrial hemp.

In late 2015, CRS staff attempted to get further clarification on USDA’s policy regarding industrial hemp and federal grants and loans to support research of industrial hemp with limited success. Information provided from USDA was not always consistent and often conflicting.¹²⁰ According to USDA’s National Institute of Food and Agriculture (NIFA), the agency had not awarded any competitive research grants for industrial hemp (as of September 2015).¹²¹ However, subsequent searches of USDA’s Current Research Information System (CRIS) database¹²² indicate that NIFA formula-funded grants were used at Colorado State University for 2015 under available Hatch Act funding to study hemp cultivation as part of bigger grants about profitability of alternative agriculture in southern Colorado.¹²³ Other available information, including correspondence between USDA and various congressional staff, suggests that USDA has no record of any application for industrial hemp research being denied. No additional information is available on whether any such applications had been proposed, or would or could be approved.

A USDA memo dating back to December 2014 states that “NIFA supports” grants for industrial hemp research, as long as that research meets existing state requirements consistent with the

¹¹⁶ CRS communication with Project CBD representatives, September 22, 2014.

¹¹⁷ FDA, “Warning Letters and Test Results,” <http://www.fda.gov/NewsEvents/PublicHealthFocus/ucm435591.htm>.

¹¹⁸ See, for example, Kentucky Hemp Industries Council, “Industrial Hemp-Derived Cannabidiol (Hemp CBD).”

¹¹⁹ This section written with contributions from (name redacted) [redacted]@crs.loc.gov-...., who handles issues regarding USDA’s research programs.

¹²⁰ CRS communications during 2015 with USDA, including the Department’s Office of Congressional Relations and program offices with USDA’s National Institute of Food and Agriculture (NIFA) and Rural Development agencies.

¹²¹ CRS communications with USDA, September 2015. NIFA provides funding for programs and grants to researchers and land grant universities that advance agriculture-related sciences. For more information on USDA research programs, see CRS Report R40819, *Agricultural Research: Background and Issues*.

¹²² USDA’s searchable CRIS database is at <http://cris.nifa.usda.gov/search.html>.

¹²³ Includes (1) “Research and Education to Enhance the Sustainability of Farming in Southwestern Colorado” (COL00615A) and (2) “Field Crop Testing and Management in Southwestern Colorado” (COL00615). The Hatch Act of 1887 provides for multistate research funding is to conduct agricultural research programs at State Agricultural Experiment Stations across all 50 states, the District of Columbia, and the territories.

requirements in the 2014 farm bill (P.L. 113-79, §7606; 7 U.S.C. 5940).¹²⁴ However, USDA staff indicated that the December 2014 memo pertains only to what the statutory provision authorizes and does not say anything explicitly about federal funding of industrial hemp research.¹²⁵ Although this response did not address the underlying issue regarding federal funding, it likely indicates that researchers working on industrial hemp may carry on with this work at least on their own (according to requirements specified in the 2014 farm bill) without threatening their status and working relationship with USDA.

Other communication with USDA's Rural Development agency indicated that the agency's Rural Business-Cooperative Service (RBS) has initiated conversation with USDA's Office of the General Counsel to review whether the industrial hemp industry could potentially be supported by its programs.¹²⁶ There does not appear to be any legal reason why USDA would not be able to provide grant funding for research activities on industrial hemp within the language of the 2014 farm bill provision, and the question remains about whether USDA will fund such applications in the future.

The appropriations provisions (discussed in "FY2015 and FY2016 Appropriations Provisions"), while addressing the legality of activity and enforcement of penalties, have not sufficiently addressed federal funding of grants. These circumstances might suggest the need to obtain a consistent statement (preferably in writing) from USDA on whether industrial hemp research projects are eligible for USDA competitive grants (for example, under USDA's Agriculture and Food Research Initiative program) and/or for Hatch Act formula funds, as well as clarification about whether hemp producers are eligible for other types of agricultural support from other USDA agencies (such as loans and grants administered by USDA's Rural Development agency). In November 2015, several Members of Congress sent a letter to USDA requesting clarification of the agency's research funds for industrial hemp.¹²⁷ Other options might include statutory revision or appropriations clarification to address program funding eligibility.

Some have suggested that perhaps industrial hemp might qualify under certain other USDA grant programs, such as NIFA's Specialty Crop Research Initiative. However, industrial hemp is not included among the crops that are considered "specialty crops" and technically would not qualify for any grant specifically designated for specialty crop producers.¹²⁸

Some constituent groups have also expressed an interest in applying for other non-USDA grants, such as the "Small Business Innovation Research program," intended to help certain small businesses conduct research and development, coordinated by the Small Business Administration. CRS has not contacted other federal agencies aside from USDA.

¹²⁴ Letter from NIFA's Director Ramaswamy to Eric Young, executive director of the Southern Association of Agriculture Experiment Station Directors, December 23, 2014.

¹²⁵ CRS communications with USDA, October 2015.

¹²⁶ CRS communications with USDA, August 2015. USDA's Rural Development agency administers both business loans and grants.

¹²⁷ Letter to USDA Secretary Tom Vilsack signed by 37 Representatives and 12 Senators, November 20, 2015.

¹²⁸ "Specialty crops" are defined in statute as "fruits and vegetables, tree nuts, dried fruits, and horticulture and nursery crops (including floriculture)" (7 U.S.C. §1621 note). This definition was originally defined in the Specialty Crops Competitiveness Act of 2004 (P.L. 108-465, Section 3). See USDA, "USDA Definition of Specialty Crop," <http://www.ams.usda.gov/AMSv1.0/getfile?dDocName=STELPRDC5082113>. Appendix F lists ineligible crops, including hemp and other fiber crops. Industrial hemp is considered among the "List of Ineligible Commodities" (<http://www.ams.usda.gov/services/grants/scbgp/specialty-crop>).

Federal Research of Cannabidiol¹²⁹

Cannabidiol (CBD) is a non-psychoactive compound in *Cannabis* “produced either directly from cannabis flowers that are up to 15% CBD (150,000 ppm), or indirectly as a co-product of flowers and leaves that are mixed in with the stalks during hemp stalk processing for fiber.”¹³⁰ The “Charlotte’s Web” reference in the House bill refers to a high-CBD (low THC) *Cannabis* extract that has been marketed as a dietary supplement. Such products have been marketed as helping to address various ailments, including neuropathic pain, epilepsy, post-traumatic stress disorder, nausea as a result of chemotherapy, and other disorders.¹³¹

To date, FDA has not approved any drug product containing CBD for any indication and has issued warning letters to several companies that market CBD products to treat health conditions for both humans and pets. As reported by FDA:¹³²

In late February 2015, FDA issued several warning letters to firms that market unapproved drugs for the diagnosis, cure, mitigation, treatment, or prevention of diseases. Some of these firms claim that their products contain cannabidiol (CBD). FDA has tested those products and, in some of them, did not detect any CBD. It is important to note that these products are not approved by FDA for the diagnosis, cure, mitigation, treatment, or prevention of any disease, and often they do not even contain the ingredients found on the label. Consumers should beware purchasing and using any such products.

According to FDA these products are not “generally recognized as safe and effective” and the companies marketing these products are engaging in illegal interstate commerce.¹³³

FDA further has determined that products containing CBD cannot be sold as dietary supplements and are excluded from the dietary supplement definition in the Federal Food, Drug, and Cosmetic Act.¹³⁴ As such FDA may consult with its federal and state partners about whether to initiate a federal enforcement action against the manufacturers of CBD products that are marketed as dietary supplements.

There is growing concern that hemp-based CBD products, derived from industrial hemp, are being marketed as being rich in CBD and as having comparable therapeutic uses to CBD extracts. However, CBD is not produced or pressed from hemp seeds. Hemp seed oil, marketed as “hemp oil,” is made by pressing hemp seeds that contain low levels of CBD (typically less than 25 parts per million [ppm]). As noted by HIA:¹³⁵

CBD is not a product or component of hemp seeds, and labeling to that effect is misleading.... Hemp seed oil does not contain any significant quantity of CBD. Hemp fiber and seed cultivars contain relatively minimal CBD and CBD production from such

¹²⁹ For more information on the role of CBD within U.S. drug industry, as regulated by the Food and Drug Administration (FDA), contact (name redacted) [redacted]@crs.loc.gov , 7-....).

¹³⁰ “Hemp Industries Association Position on CBD Extracts Misbranded and Marketed as “Hemp Oil,” June 26, 2014, <http://www.thehia.org/Resources/PressReleases/HIA-position-CBD-FINAL.pdf>.

¹³¹ Named after Charlotte Figi, who suffers from a rare pediatric seizure disorder and who reportedly has experienced relief from seizures with this strain of medical marijuana that is high in CBD and low in THC.

¹³² FDA, “Warning Letters and Test Results,” <http://www.fda.gov/NewsEvents/PublicHealthFocus/ucm435591.htm>.

¹³³ Comments attributed to FDA, as reported by S. Nelson, “FDA Brings Down Hammer on CBD Companies,” *U.S. News and World Report*, March 11, 2015.

¹³⁴ Federal Food, Drug, and Cosmetic Act, §201(ff)(3)(B)(ii). For more information, see FDA, “FDA and Marijuana: Questions and Answers,” September 30, 2015, <http://www.fda.gov/NewsEvents/PublicHealthFocus/ucm421168.htm>.

¹³⁵ “Hemp Industries Association Position on CBD Extracts Misbranded and Marketed as “Hemp Oil,” June 26, 2014, <http://www.thehia.org/Resources/PressReleases/HIA-position-CBD-FINAL.pdf>.

plants should not be considered a primary product. There are high CBD cultivars that may qualify as “hemp” under federal law, however the genetics for such cultivars are closely held by various parties, and generally hemp cultivars available to American farmers are not suitable for producing CBD.

Most of the CBD extracts currently being marketed for certain therapeutic purposes are generally formulated from strains of cannabis with THC levels higher than 0.3% but generally less than 1% THC.¹³⁶ Nevertheless, research continues to be conducted in some states on the potential uses for industrial hemp-derived CBD.¹³⁷ Most agriculture-based groups continue to advocate for the need for such research and for reducing barriers to conducting further studies.¹³⁸

In June 2015, the Senate Caucus on International Narcotics Control, led by Senators Chuck Grassley and Dianne Feinstein, held a hearing on the barriers to research and the potential medical benefits of CBD. The caucus leaders claimed many leading medical organizations have called for further research into the potential medical use of CBD. The hearing addressed the complexities involved with conducting CBD research, as well as its potential medical benefits and risks in treating serious illnesses. The hearing provided a follow-up to letters sent by the caucus leaders to the Department of Justice (DOJ) and to the Department of Health and Human Services (HHS) to ask these agencies to evaluate CBD using the appropriate scientific and medical factors to make a scheduling determination for it that is separate from the whole marijuana plant. The caucus anticipates that “If it turns out that CBD may be classified on a lower schedule than the entire marijuana plant, then research on it may proceed somewhat more easily.”¹³⁹ The caucus reported that DOJ and HHS have agreed to undertake this evaluation,¹⁴⁰ representing “for the first time, the federal government will conduct a comprehensive analysis to determine whether cannabidiol has scientific and medical value.”¹⁴¹

Groups Supporting/Opposing Further Legislation

In addition to groups such as HIA and Vote Hemp Inc. that are actively promoting reintroducing hemp as a commodity crop in the United States, some key agricultural groups also support U.S. policy changes regarding industrial hemp. For example:

- The National Farmers Union (NFU) updated its 2013 farm policy regarding hemp to urge the President, Attorney General, and Congress to “direct the U.S. Drug Enforcement Administration (DEA) to reclassify industrial hemp as a non-controlled substance and adopt policy to allow American farmers to grow industrial hemp under state law without affecting eligibility for USDA

¹³⁶ CRS communication with Project CBD representatives, September 22, 2014.

¹³⁷ See, for example, “Research on Industrial Hemp Continues to Progress,” PHYS.org website, August 2015. See also “The Kentucky Department of Agriculture Industrial Hemp Pilot Projects—2014 Summary” (includes KDA CBD Project: “This project is focusing on the production of a very specific type of hemp to develop a nutritional supplement containing cannabidiol (CBD) and evaluate its health benefits”).

¹³⁸ See, for example, Kentucky Hemp Industries Council, “Industrial Hemp-Derived Cannabidiol (Hemp CBD).”

¹³⁹ Opening Statement of Senator Chuck Grassley of Iowa Chairman Senate Caucus on International Narcotics Control Committee, Committee on Senate Caucus on International Narcotics Control hearing, June 24, 2015.

¹⁴⁰ See, for example, letter dated January 5, 2015 to Sen. Feinstein from the DOJ and letter dated May 13, 2015, to Sen. Grassley from HHS. See also letter from DOJ to Sens. Grassley and Feinstein, June 23, 2015.

¹⁴¹ Press release by Sen. Feinstein, “Feinstein, Grassley Announce New Federal Policy on Cannabidiol Research,” June 23, 2015.

- benefits.”¹⁴² Previously NFU’s policy advocated that the DEA “differentiate between industrial hemp and marijuana and adopt policy to allow American farmers to grow industrial hemp under state law without requiring DEA licenses.”¹⁴³
- The National Association of State Departments of Agriculture (NASDA) “supports revisions to the federal rules and regulations authorizing commercial production of industrial hemp,” and has urged USDA, DEA, and the Office of National Drug Control Policy to “collaboratively develop and adopt an official definition of industrial hemp that comports with definitions currently used by countries producing hemp.” NASDA also “urges Congress to statutorily distinguish between industrial hemp and marijuana and to direct the DEA to revise its policies to allow USDA to establish a regulatory program that allows the development of domestic industrial hemp production by American farmers and manufacturers.”¹⁴⁴
 - In 2014, the American Farm Bureau Federation, from efforts led by the Indiana Farm Bureau, endorsed a policy to support the “production, processing, commercialization, and utilization of industrial hemp,”¹⁴⁵ and reportedly also passed a policy resolution to oppose the “classification of industrial hemp as a controlled substance.” Previously, in 1995, the Farm Bureau had passed a resolution supporting “research into the viability and economic potential of industrial hemp production in the United States... [and] further recommend that such research includes planting test plots in the United States using modern agricultural techniques.”¹⁴⁶
 - Regional farmers’ organizations also have policies regarding hemp. For example, the North Dakota Farmers Union (NDFU), as part of its federal agricultural policy recommendations, has urged “Congress to legalize the production of industrial hemp.”¹⁴⁷ The Rocky Mountain Farmers Union (RMFU) has urged “Congress and the USDA to re-commit and fully fund research into alternative crops and uses for crops” including industrial hemp; also, they “support the decoupling of industrial hemp from the definition of marijuana” under the CSA and “demand the President and the Attorney General direct the U.S. Drug Enforcement Agency (DEA) to differentiate between industrial hemp and marijuana and adopt a policy to allow American farmers to grow industrial hemp under state law without requiring DEA licenses,” to “legalize the production of industrial hemp as an alternative crop for agricultural producers.”¹⁴⁸

¹⁴² NFU, “Policy of the National Farmers Union,” March 2-5, 2013.

¹⁴³ NFU, “National Farmers Union Adopts New Policy on Industrial Hemp,” March 22, 2010. Also see NFU, “Policy of the National Farmers Union,” enacted by delegates to the 108th annual convention, Rapid City, SD, March 14-16, 2010.

¹⁴⁴ NASDA, “New Uses of Agricultural Products,” 2010, <http://www.nasda.org/cms/7196/9017/9350/7945.aspx>.

¹⁴⁵ “AFBF Delegates Fine Tune Policies on WOTUS, Embrace Hemp,” *Agri-Pulse*, January 14, 2015.

¹⁴⁶ See, for example, J. Patton, “American Farm Bureau Calls for End to Federal Ban on Hemp Production,” *Lexington Herald-Leader*, January 22, 2014; and “Farm Bureau Passes Policy Urging Removal of Industrial Hemp Classification as Controlled Substance,” *Lane Report*, January 22, 2014.

¹⁴⁷ NDFU, “2010 Program of Policy & Action,” p. 8; also see <http://www.ndfu.org>.

¹⁴⁸ RMFU, “Policy 2010,” <http://www.rmfu.org/pdfs/RMFUPolicy10.pdf>, p. 6, pp. 15-16, and p. 24.

- The National Grange voted in 2009 to support “research, production, processing and marketing of industrial hemp as a viable agricultural activity.”¹⁴⁹
- In California, ongoing efforts to revise the definition of marijuana to exclude “industrial hemp” (SB 566) are supported by the state’s sheriffs’ association.¹⁵⁰ Previous efforts in 2011 to establish a pilot program to grow industrial hemp in selected counties were supported by the county farm bureau and two sheriff’s offices (although the bill, SB 676, was later vetoed by the state’s governor).¹⁵¹

Despite support by some, other groups continue to oppose policy changes regarding cannabis. For example, the National Alliance for Health and Safety, as part of Drug Watch International, claims that proposals to reintroduce hemp as an agricultural crop are merely a strategy by “the international pro-drug lobby to legalize cannabis and other illicit substances.”¹⁵² The California Narcotic Officer’s Association claims that allowing for industrial hemp production would undermine state and federal enforcement efforts to regulate marijuana production, since they claim the two crops are not distinguishable through ground or aerial surveillance, but would require costly and time-consuming lab work to be conducted.¹⁵³ This group also claims that these similarities would create an incentive to use hemp crops to mask illicit marijuana production, since marijuana is such a lucrative cash crop.¹⁵⁴ Concerns about the potential linkages to the growing and use of illegal drugs are also expressed by some parent and community organizations, such as Drug Free America Foundation, Inc. and PRIDE Inc.¹⁵⁵

Given the DEA’s current policy positions and perceived DEA opposition to changing its current policies because of concerns over how to allow for hemp production without undermining the agency’s drug enforcement efforts and regulation of the production and distribution of marijuana, hemp proponents say that further policy changes regarding industrial hemp are likely not forthcoming absent congressional legislative action.

Concluding Remarks

Hemp production in the United States faces a number of obstacles in the foreseeable future. The main obstacles facing this potential market are U.S. government drug policies and DEA concerns about the ramifications of U.S. commercial hemp production. These concerns are that commercial cultivation could increase the likelihood of covert production of high-THC marijuana, significantly complicating DEA’s surveillance and enforcement activities and sending the wrong message to the American public concerning the government’s position on drugs. DEA officials and a variety of other observers also express the concern that efforts to legalize hemp—as well as

¹⁴⁹ National Grange, “Legislative Policies,” http://www.nationalgrange.org/legislation/policy/policy_ag.htm; also see National Grange, “Hemp Policy,” <http://www.grangehemppolicy.info/>.

¹⁵⁰ Letter from the California State Sheriffs’ Association to Chairwoman Cathleen Galgiani of the State Senate Agriculture Committee, March 21, 2013.

¹⁵¹ Letters of support for SB 678 to California State Senator Mark Leno from the Imperial County Farm Bureau (June 16, 2011), Office of Sheriff, Kings County (July 19, 2011), and Office of Sheriff, Kern County (July 21, 2011).

¹⁵² See, for example, Drug Watch International, “Position Statement on Hemp (*Cannabis sativa* L.),” November 2002.

¹⁵³ Letter from the California Narcotic Officers’ Association to Governor Arnold Schwarzenegger, September 18, 2007.

¹⁵⁴ CRS conversation with John Coleman, August 22, 2011.

¹⁵⁵ Information provided to CRS by Jeanette McDougal, National Alliance for Health and Safety, August 22, 2011.

those to legalize medical marijuana—are a front for individuals and organizations whose real aim is to see marijuana decriminalized.¹⁵⁶

Hemp production in the United States also faces competition from other global suppliers. The world market for hemp products remains relatively small, and China, as the world's largest hemp fiber and seed producer, has had and likely will continue to have major influence on market prices and thus on the year-to-year profits of producers and processors in other countries.¹⁵⁷ Canada's head start in the North American market for hemp seed and oil also would likely affect the profitability of a start-up industry in the United States.

Nevertheless, the U.S. market for hemp-based products has a highly dedicated and growing demand base, as indicated by recent U.S. market and import data for hemp products and ingredients, as well as market trends for some natural foods and body care products. Given the existence of these small-scale, but profitable, niche markets for a wide array of industrial and consumer products, commercial hemp industry in the United States could provide opportunities as an economically viable alternative crop for some U.S. growers.

¹⁵⁶ For more information on legislative and executive branch actions concerning illegal drugs, see CRS Report RL32352, *War on Drugs: Reauthorization and Oversight of the Office of National Drug Control Policy*. For information on issues pertaining to medical marijuana, see CRS Report RL33211, *Medical Marijuana: Review and Analysis of Federal and State Policies*.

¹⁵⁷ T. R. Fortenbery and M. Bennett, "Opportunities for Commercial Hemp Production," *Review of Agricultural Economics*, vol. 26, no. 1 (Spring 2004), pp. 97-117. The time period covered in this study ends with the year 2000.

Appendix. Listing of Selected Hemp Studies

Below is a listing of reports and studies, ranked by date (beginning with the most recent).

- University of Kentucky, Department of Agricultural Economics, *Economic Considerations for Growing Industrial Hemp: Implications for Kentucky's Farmers and Agricultural Economy*, July 2013, <http://www2.ca.uky.edu/cmsspubsclass/files/EconomicConsiderationsforGrowingIndustrialHemp.pdf>.
- C. A. Kolosov, "Regulation of Industrial Hemp Under the Controlled Substances Act" *UCLA Law Review*, vol. 57, no. 237, October 2009, <http://uclalawreview.org/pdf/57-1-5.pdf>.
- Manitoba Agriculture, *National Industrial Hemp Strategy*, March 2008 (prepared for Food and Rural Initiative Agriculture and Agri-Food Canada).
- Reason Foundation, "Illegally Green: Environmental Costs of Hemp Prohibition," Policy Study 367, March 2008, <http://www.reason.org/ps367.pdf>.
- Agriculture and Agri-Food Canada, *Canada's Industrial Hemp Industry*, March 2007, http://www.agr.gc.ca/misb/spcrops/sc-cs_e.php?page+hemp-chanvre.
- Maine Agricultural Center, *An Assessment of Industrial Hemp Production in Maine*, January 2007, <http://www.mac.umaine.edu/>.
- N. Cherrett et al., "Ecological Footprint and Water Analysis of Cotton, Hemp and Polyester," Stockholm Environment Institute, 2005, <http://www.sei-international.org/mediamanager/documents/Publications/Future/cotton%20hemp%20polyester%20study%20sei%20and%20bioregional%20and%20wwf%20wales.pdf>.
- T. R. Fortenbery and M. Bennett, "Opportunities for Commercial Hemp Production," *Applied Economics Perspectives and Policy*, 26(1): 97-117, 2004.
- E. Small and D. Marcus, "Hemp: A New Crop with New Uses for North America," in *Trends in New Crops and New Uses*, 2002, <http://www.hort.purdue.edu/newcrop/ncnu02/v5-284.html>.
- T. R. Fortenbery and M. Bennett, "Is Industrial Hemp Worth Further Study in the U.S.? A Survey of the Literature," Staff Paper No. 443, July 2001, <http://ageconsearch.umn.edu/bitstream/12680/1/stpap443.pdf>.
- J. Bowyer, "Industrial Hemp (*Cannabis sativa* L.) as a Papermaking Raw Material in Minnesota: Technical, Economic and Environmental Considerations," Department of Wood & Paper Science Report Series, May 2001.
- K. Hill, N. Boshard-Blackey, and J. Simson, "Legislative Research Shop: Hemp," University of Vermont, April 2000, <http://www.uvm.edu/~vlrs/doc/hemp.htm>.
- USDA, Economic Research Service, *Industrial Hemp in the United States: Status and Market Potential*, AGES001E, January 2000, <http://www.ers.usda.gov/publications/ages001e/ages001em.pdf>.
- M. J. Cochran, T. E. Windham, and B. Moore, "Feasibility of Industrial Hemp Production in Arkansas," University of Arkansas, SP102000, May 2000.
- D. G. Kraenzel et al., "Industrial Hemp as an Alternative Crop in North Dakota," AER 402, North Dakota State University, Fargo, July 1998, <http://ageconsearch.umn.edu/handle/23264>.

- E. C. Thompson et al., *Economic Impact of Industrial Hemp in Kentucky*, University of Kentucky, July 1998.

D. T. Ehrensing, *Feasibility of Industrial Hemp Production in the United States Pacific Northwest*, SB 681, Oregon State University, May 1998, <http://extension.oregonstate.edu/catalog/html/sb/sb681/>.

Author Contact Information

(name redacted)
Specialist in Agricultural Policy
[redacted]@crs.loc.gov7-....

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