

THE NORTH CAROLINA INDUSTRIAL HEMP ASSOCIATION INFORMATIONAL PACKET ON INDUSTRIAL HEMP USE THROUGHOUT THE US, CANADA, AND PARTS OF EUROPE

Industrial hemp can be grown as a fiber, seed, or dual-purpose crop. 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.

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. 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.

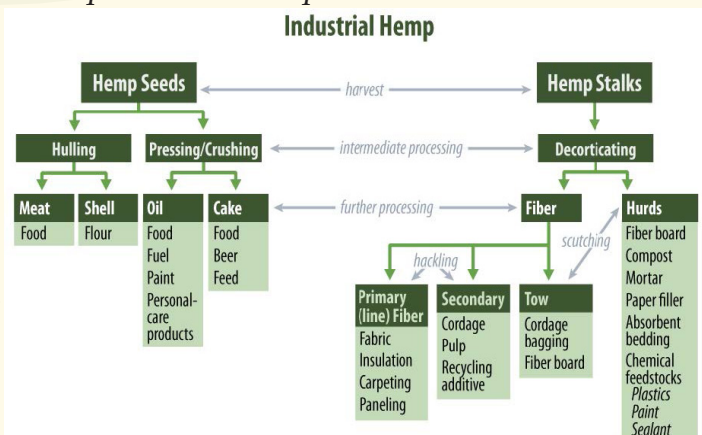
Although hemp is not grown in the United States, both finished hemp products and raw material inputs are imported and sold for use in manufacturing for a wide range of product categories. Hemp fibers are used in a wide range of products, including fabrics and textiles, yarns and spun fibers, paper, carpeting, home furnishings, construction and insulation materials, auto parts, and composites. Hurds are used in various applications such as animal bedding, material 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. Hemp seed is also used for industrial oils, cosmetics and personal care products, and pharmaceuticals, among other composites.

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.

The Hemp Industries Association (HIA) estimates that the total U.S. retail value of hemp products in 2012 was nearly \$500 million, which includes food and body products, clothing, auto parts, building materials and other products. Of this, HIA reports that the value of hemp-based food, supplements, and body care sales in the United States is about \$156 million to \$171 million annually. Previous reports about the size of the U.S. market for hemp clothing and textiles is estimated at about \$100 million annually.

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.

Hemp plants grown for fiber or oilseed are planted densely (about 35-50 plants per square foot) to discourage branching and flowering. The period of seeding to harvest ranges from 70 to 140 days, depending on the purpose, cultivar or variety, and climatic conditions.



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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 prewar 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.

Food

Hemp oil's primary value is its high content of the two essential fatty acids (EFA's) Omega-3 and Omega-6. These fatty acids are essential to tissue growth and metabolism, these critical EFA's cannot be produced by the body and must be present in the diet. Encapsulated hemp seed oil supplements are found in natural foods markets, usually next to increasingly popular flax supplements, part of a \$25 million U.S. market for EFA supplements. Flax oil, with its very high content of the Omega-3 EFA, is usually taken short term to correct Omega-3 deficiencies. Hemp oil is the better choice for long-term consumption because it contains a more desirable balance of the two EFA's. Because it is more versatile, tastier and keeps better than other high EFA oils, hemp oil is also used as a culinary ingredient. Hemp oil may be used as one would use a fine olive oil- for sauces, flavorings, dressings, low-heat cooking and sautéing. The success of fine olive oils as well as the exotic nut and seed oils category (grapeseed, hazelnut, macadamia, etc.) provides a strong indication that pure, bottled hemp seed oil would have a moderate yet lucrative market. In addition to bottled oil, there are many fine food preparations on the market that utilize hemp seed oil as the key ingredient, such as salad dressings and other oil-based marinades, chutneys and sauces.

Cosmetics

Since the introduction of The Body Shop's line of hemp based body lotion, hand cream, soap and lip conditioner to the global marketplace, demand for hemp oil has grown rapidly. Revlon's Absolutely Fabulous line of hemp oil based lipsticks premieres this spring in major retail chains such as Target, Wal-Mart, K-Mart and Walgreen's. Alterna, Rachel Perry, Kiss My Face and Jason's Natural Cosmetics have successful hair and skin care lines made with hemp seed oil. Based on function, Dr. Bronner's Magic Soaps changed its formula to use hemp oil instead of jojoba oil and has seen sales increase dramatically as a result. Hemp oil cosmetic products may also be found in many major food retailers including Wild Oats, Whole Foods, Ralph's, Kroger's and Trader Joe's markets across the U.S. Hemp oil's versatility in the personal care market is enhanced by the introduction of advanced processes that allow the oil to blend with water or be turned into gels and even solids, enabling its benefits to be incorporated into even more cosmetic formulations.

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Hemp Meal

Hemp meal, the seedcake remaining from the crush, contains a large fraction of protein, with a composition similar to that of soy. This makes it an ideal animal feed, but further processing will also yield superior products for human consumption.

Animals such as horses, cows and chickens respond well to hemp meal as a dietary supplement as it is high in protein as well as the residual EFA's. Recent trials in Kentucky reveal that hemp-fed cattle require less feed and digest it more efficiently.

Textiles

The market for hemp apparel, footwear, luggage and other accessories is based on hemp's reputation as a durable fiber for longer, more comfortable wear and colorfastness. Adidas created a hemp fabric shoe. Armani designed a tuxedo made from hemp. Calvin Klein has used hemp for years and has listed it as "vegetable fiber." Two Star Dog, a grass roots hemp company, produces apparel that is featured in Nordstrom. Currently, raw materials must be imported from Eastern Europe and China, keeping prices up for domestic producers. Local supplies of hemp fiber will encourage more business development and acceptance of hemp as a mainstream fiber for a variety of apparel and accessories.

Bast fibers, such as hemp and flax, have increasingly been used as the reinforcement fiber in composites where they can achieve higher strength and a reduction in weight. Most commonly, hemp, other natural fibers and polypropylene are blended into a non-woven mat, heated and compression molded into the final part. The result is a hard and durable shape that replaces traditional plastic or fiberglass processes. Alternately, when pressed as a flat board, it can substitute for many paneling applications that currently use wood. Ford, GM, DaimlerChrysler, Saturn, and BMW are currently using or experimenting with such materials for their door panels, trunks, head liners and other parts. In Germany, hemp fiber has significantly increased its presence in such automotive parts since 1997. The same technology applies to furniture makers who can replace costly and labor intensive plastic and wood manufacturing processes with one-step biocomposite molding. Hemp, with its superior tensile strength, is an outstanding raw material for this potentially huge market. Replacing fiberglass with biocomposite materials may also be safer for workers.

Another emerging market for hemp and flax fibers in Europe is their use in building insulation. These mats achieve the same heat retention as fiberglass mats, yet provide better sound insulation and are safer to handle. Due to the currently small production volume, they are more expensive, thus purchased primarily by eco-conscious consumers.

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The expanding role of non-woods in the papermaking process provides a timely and lucrative opportunity for hemp in the printing and writing paper sector. Several U.S. companies, such as Crane & Company, Inc., the producer of U.S. currency paper, and Living Tree Paper have begun to blend hemp fibers into their papermaking processes for additional strength, appealing to environmentally conscious buyers. Hemp's bast fibers contain the highest cellulose (85%) and the lowest lignin content (3-5%); much of the energy and chemical intensive method for pulp processing is related to the removal of lignin, which binds the cellulose together. The short fibers from the core contain relatively high cellulose as well (70%) with a higher lignin content of 23%. By contrast, wood's lignin content runs as high as 34% with cellulose content around 50%.

Animal Bedding

Currently, the vast majority of hemp hurds produced in the European Union is sold as bedding for horses and other animals. The Queen of England uses hemp bedding for her horses. Compared to the low-price competitor cereal straw, hemp hurd bedding exposes sensitive animals to less dust and fungal spores and achieves considerably higher absorbency, thus requiring less maintenance and minimizing odors. Unsanitary conditions on bird farms are compounded by the use of wood chips in the manure trays. Inefficient absorbents with little nitrogen uptake, wood chips result in toxic sludge, agricultural runoff and health problems. Technology exists to use hemp core for the absorption of manure and convert the absorbed product into pathogenfree organic fertilizer.

Table 1. Value and Quantity of U.S. Imports of Selected Hemp Products, 1996-2011

	units	1996	2000	2005	2007	2008	2009	2010	2011
Hemp Seeds (HS 1207990220) ^a	\$1000	—	—	271	2,350	3,111	3,320	5,154	6,054
Hemp Oil and Fractions (HS 1515908010)	\$1000	—	—	711	693	835	726	1,129	839
Hemp Seed Oilcake and Other Solids (HS 2306900130)	\$1000	—	—	—	—	460	1,811	2,369	2,947
True Hemp, raw/processed not spun (HS 5302)	\$1000	100	525	101	88	57	52	33	41
True Hemp Yarn (HS 5308200000)	\$1000	25	396	68	82	202	212	115	425
True Hemp Woven Fabrics (HS 5311004010)	\$1000	1,291	1,617	923	1,579	1,924	751	1,024	1,188
Total		1,416	2,538	2,074	4,789	6,589	6,872	9,822	11,494
Hemp Seeds (HS 1207990220) ^a	metric ton	—	—	92	355	523	602	711	623
Hemp Oil and Fractions (HS 1515908010)	metric ton	—	—	114	99	98	92	134	137
Hemp Seed Oilcake and Other Solids (HS 2306900130)	metric ton	—	—	—	—	56	201	2239	298
True Hemp, raw/processed not spun (HS 5302)	metric ton	53	620	121	102	44	36	28	16
True Hemp Yarn (HS 5308200000)	metric ton	6	60	8	9	51	45	22	64
Subtotal		59	680	335	565	772	976	1,134	1,138
True Hemp Woven Fabrics (HS 5311004010)	m2 (1000)	435	654	248	411	479	167	268	251

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Table 1. Hemp fiber usage in the European Union in 1999 (after Karus et al. 2000).

Class of product	Quantity consumed (tonnes)	Relative percentage
Specialty pulp (cigarette paper, bank notes, technical filters, and hygiene products)	24,882	87
Composites for autos	1,770	6
Construction & thermal insulation materials	1,095	4
Geotextiles	234	0.8
Other	650	2.2
Total	26,821	100

Table 2. Analysis of commercial *Cannabis* product potential in North America in order of decreasing value toward the right and toward the bottom.

"Seeds" (achenes)	Long ("bark") fiber	Woody stem core	Female floral (perigonal) bract	Whole plant
Confectionary, baked goods	Plastic-molded products	Animal bedding	Medicinal cannabinoids	Alcohol
Salad oil	Specialty papers	Thermal insulation		Fuel
Body care "cosmetics"	Construction fiberboard	Construction (fiberboard, plaster board, etc.)	Essential oil (for flavor & perfume)	Silage
Animal food (whole seeds for birds, press-cake for mammalian livestock)	Biodegradable landscape matting & plant culture products		Insect repellent	
Gamma-linolenic acid dietary supplements	Coarse textiles (carpets, upholstery)			
Specialty industrial oils	Fine textiles			