

5. NON-MEDICINAL USES OF *CANNABIS SATIVA*

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INTRODUCTION

The plant *Cannabis sativa* has been providing man with a range of his most basic needs for centuries (Conrad, 1994a). We know that hemp—the fibrous extract of *C. sativa*, was used for clothing in ancient Egypt, at least as early as 1,200 years BC and the use of the plant as a source of rope is well documented in many cultures down the centuries (see [Chapter 1](#), this volume, for a full account). The seeds from the plant have been subjected to various treatments to provide food and the fibre has also been used from early times as a major paper making material; indeed, early editions of the Gothenburg and King James Bibles were published on such paper and much later, the first two drafts of the American Declaration of Independence. The new president of the United States, George Washington was to be found exhorting his head gardener to: “Make the most of the Indian hemp seed...and sow it everywhere” (Washington, 1794).

These peaceful uses were not the only ones however. From the 17th century onwards, the British Royal Navy—at the time the most powerful navy in the world—relied heavily on hemp for ropes, rigging and caulking. In the mid-1800s, a typical 44-gun man of war might inventory some 60 tons of hemp rope, rigging and anchor cable, often impregnated with tar to improve the already excellent resistance to rotting encouraged by constant exposure to sea water; not to mention the hemp-derived oakum, forced between the planks to make her watertight. The sails were made of ‘canvas’ a derivation from an Arabic word for hemp. Soldiers’ and sailors’ clothing and their battle flags were likely to be made of hemp material also. The original ‘Levi’s’ jeans were made from recycled hemp sail cloth and in World War 2, hemp was widely cultivated in the US and Germany performing many vital functions, from fire hoses to parachute webbing.

CULTIVATION

This chapter is not intended to be an agricultural or horticultural manual for those interested in growing the plant for legitimate commercial gain. [Chapter 2](#) provides a fairly detailed historical account of cultivation and subsequent processing of *C. sativa* and the interested reader is referred to this text and its accompanying references (see also: Conrad, 1994b; Judd, 1995). For those requiring further information, references are provided in the bibliography to organisations which may provide additional advice in this area.

The reader is referred to Chapter 2 for a general description of the conditions necessary for growth of strains of *C. sativa* which are low in psychoactive

cannabinoids. It can be seen that the plant is not fastidious; indeed, the cannabis plant requires little care and attention yet under moderately intensive conditions, provides one of the longest and most versatile cellulose fibres of any plant. It has been shown that under sustainable growth conditions, on an acre for acre basis, hemp produces four times as much fibre pulp as wood (Dewey and Merrill, 1916) and the yield is 200% better than cotton—a crop which requires intensive pesticide treatment to succeed.

The plant is a rapid grower, attaining a height of 10–12 feet in 12–14 weeks. Under normal conditions, the seed yield is from 12–15 bushels per acre with an average of 16–18. Twenty percent of the plant is fibre and depending on strain, growth conditions and processing, the fibre yield can be two to three times that of flax or cotton, in a range of 400–2500 pounds per acre with a mean of approximately 1000 pounds (Dewey, 1916). One acre of hemp can produce 10 dry tonnes of animal feed, including stalk and foliage; this yield may be increased with intensive fertilisation.

It has been argued by environmentalists that hemp and other products from *C. sativa* can be produced with a favourable environmental impact: for example, hemp requires minimal herbicides and pesticides and the plant has a very long tap root which discourages soil erosion.

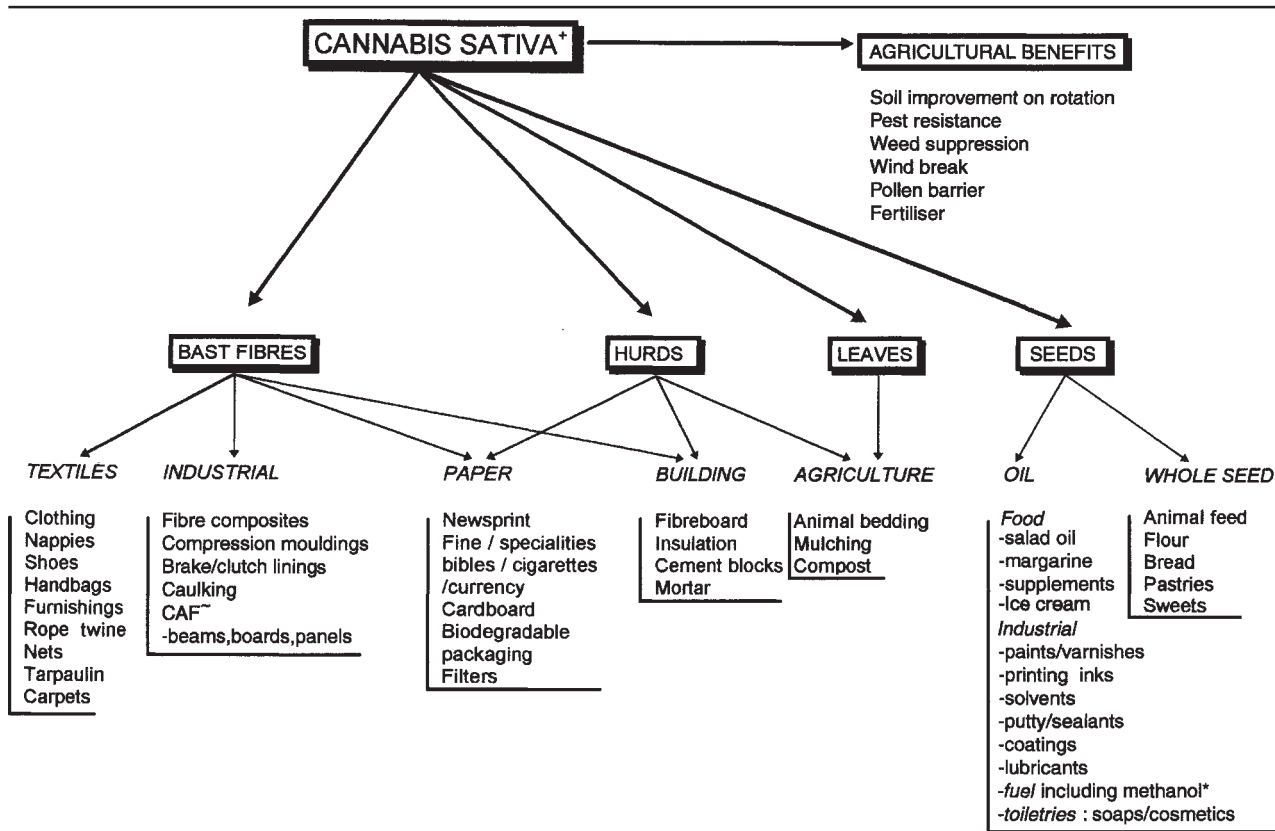
As far as illicit growth of the plant is concerned, then the methods used to cultivate cannabis are as ingenious as they are devious. Clandestine, domestic cultivation operations are unearthed (and summarily dismantled by the authorities) with monotonous regularity. Sophisticated systems have been discovered only after many months of undetected operation without, apparently, knowledge of close neighbours. Because high-intensity light is a requirement, ambitious growers have resorted to the theft of sources of more or less the correct specifications from places as bizarre as 100ft up a floodlighting pylon at a soccer stadium and the external illuminations of historic buildings. Techniques for the cultivation of herbal cannabis are described elsewhere (Conrad, 1994c; Rosenthal, 1984).

This chapter does not describe the medicinal or recreational uses of Cannabis (see [Chapters 1, 6–8](#) for this), but seeks rather to provide an overview of the plant as a contemporary source of a range of useful materials and provides some insight into the social, geo-political and economical influences which shape our attitudes to use of *C. sativa* in this way.

CURRENT USES

As early as 1938, the American periodical *Popular Mechanics* published an article entitled ‘New Billion-Dollar Crop’ in which it was claimed that 25,000 products could be manufactured from hemp. This may have been an imaginative over-estimate then; but in reality, the diversity of applications is stunning enough (see [Table 1](#)).

A brief description of the major uses is given below. Textiles and fine writing papers can be made from the long bast fibres. The hurds (the tougher core of the stem) can be ground down into a powder which can be used for a variety of products, including fibreboard, panelling, plywood, cavity wall insulation, packaging and even babies’ nappies.

Table 1 Morden applications for *C. sativa* (hemp)

* In addition to the above uses, hemp may also be used as a boiler fuel and to produce energy through pyrolysis (Osburn, 1989).

~ Compressed agricultural fibre.

* See [Chapter 7](#), this volume, for a summary of the medicinal application of cannabis.

Textiles

Before the industrial revolution, hemp was a major European crop for textile manufacture. However, the invention of machinery capable of extracting and processing the fibre from cotton (notably the cotton gin) saw a rapid expansion of cotton at the expense of hemp, where heavy manual work was still required to extract the long bast fibres. It was not until the 1930s that machines were built which could extract hemp fibre economically. An economic process for manufacturing paper was developed at about the same time (see below). These methods arrived at a time when the cotton and associated chemical and petrochemical industries were extremely powerful and some have argued that it was for this reason that legislation—ostensibly anti-drugs in nature, in the form of the Marihuana Tax Act of 1937—was passed which effectively prohibited hemp farming in the US (Conrad, 1994d; Herer, 1991).

Hemp made a brief re-emergence during the Second World War, particularly in America and Germany, when imported fibre was in short supply. In 1943, some 250,000 acres were turned over to hemp production in the US alone (Hopkins, 1951); even school children were encouraged to plant their own hemp patch to help the war effort, the youngsters being proud members of a local '4-H club'. The populace of Germany was exhorted to a similar extent (Reich Nutritional Institute 1943) and in 1943, some 24,700 acres was under hemp (*hanf*) cultivation. But when the war ended, hemp farming permits were cancelled in the US and hemp production all but ceased. A total ban meant that all legal production in the US had ceased by 1957; cultivation is still illegal to this day.

Permits for hemp cultivation have been issued in a number of EC member states and the plant is grown on a much larger scale in countries such as China and Hungary where cultivation has never been banned. This is largely in recognition of the fact that hemp textiles offer a wide range of uses from everyday, sports and protective clothing to carpeting and home furnishings. It is claimed that hemp fibres are stronger, more lustrous and absorbent and are more mildew-resistant than cotton fibres. They may also be blended with cotton, to give fabrics and clothing with the advantages of both raw materials.

Paper

Hemp fibres are among the longest and strongest of natural cellulose fibres. They make excellent quality paper for books, magazines and stationery; the shorter fibres make newsprint, tissue paper and packaging materials. Hemp has a low lignin content, requiring less aggressive chemical bleaching. The paper produced is resistant to age-related yellowing which occurs with wood-derived paper and hemp paper is amenable to recycling. Production of paper derived from hemp in the European Community has been spearheaded in Germany and in France; in the latter country, Kimberly Clark (a US Fortune 500 company) operates a mill producing paper for bibles and cigarettes.

Rope

As mentioned above, hemp fibre makes a strong, rot-resistant rope. Indeed, up until 1937 and the Marihuana Tax Act, it is estimated that 70–90% of all rope used in the

US was made from hemp. In countries where cultivation is not restrained, this traditional use is still widespread; but in most Western countries, modern synthetics and other plant sources such as jute and sisal are used.

Oil as a Foodstuff

Oil has been expressed from hemp seeds and used for cooking by many cultures. More recently, analysis of commercial samples of cold-pressed hemp seed oil has revealed high levels of polyunsaturated essential fatty acids: alpha linolenic acid—omega 3—(19–25% of total oil volume); linoleic acid—omega 6—(51–62%) and gamma linoleic acid (1.6%). These compounds are termed polyunsaturated fatty acids and it is a widely held view that their consumption, in place of saturated fats may have wide ranging health implications in, for example, the prevention of the development of coronary heart disease associated with consumption of the latter. Imported seeds have to be sterilised by law in many countries to prevent propagation. The best oil appears to be obtained from seeds exposed to a sterilisation process which does not involve excessive heat. At least one commercial supply is available, which is described as ‘green, delicious, but perishable—but which can be kept in the freezer for one year without spoiling’.

Hemp seed has been used as a foodstuff, both for animals and man, for centuries. Most commercial bird seed mixes contain hemp seeds. After oil extraction, the crushed seed is high in protein (approximately 25%), making it a potentially valuable agricultural animal feed. The seeds are also high in trace elements and vitamin A. After oil extraction, the crushed seed may be ground to flour and used to make bread, cakes, pastas and biscuits. The seeds can be mixed with other ingredients to make a wide range of foods, from soup to sweets, non-dairy cheese, butter and ice cream.

Hemp as a Fuel

Traditional uses of hemp as an energy source are described in [Chapter 1](#). Clearly burning any unwanted material can provide heating for domestic use in some countries in the absence of, or as a substitute for wood. One modern, but not altogether unexpected twist to this was the recent observation by the State Energy and Minerals Minister for New South Wales, Australia that large quantities of confiscated cannabis could be burnt in the state’s electricity generators, on the grounds that it was cheaper than coal and gave about the same yield in energy.

Hemp seeds contain approximately 40% by weight of a combustible oil which was traditionally used as a lantern fuel in a number of countries.

It has been suggested that the whole hemp plant might be commercially viable as a source of ‘biomass’—a term used to describe all biologically-produced matter—from which to produce fuels such as charcoal and methanol by a process known as pyrolysis (Usborn, 1989).

Paints and Resins

Hemp seed oil is a good drying agent and until the late 1930s, linseed and hemp oils were the basis for the majority of all resins, paints, shellacs and varnishes. Cheaper

petroleum-based alternatives took over at this time and it seems unlikely that hemp oil will re-emerge in this application, except perhaps in 'designer' ranges of fashionable products.

Cosmetics

Oil extracted from hemp seeds has been used as a basis for lip balm, salves, soaps and massage oil. There appear to be no particular difficulties associated with processing the oil for use in this way.

Plastics

Research has shown that hemp hurds may be processed to give cellophane packaging material in much the same way as other rich sources of cellulose. They can also be blended with recycled plastics to provide a compound for injection mouldings. The seed oil may also be converted into a plastic resin. These uses are largely experimental and are unlikely to be widespread while petrochemical derivatives remain widely available and relatively cheap. One advantage of hemp derived products is that it might be possible to develop materials which are 100% biodegradable.

HEMP CULTIVATION AROUND THE WORLD

There is a growing awareness of the economic potential for hemp products, principally textiles and clothing. The main market place is the US, with a turnover above \$50 million followed by Germany (approximately DM20 million); other countries with a stake are Spain, Austria, Switzerland, Australia, Canada, France and Norway. Egypt, India, Portugal, Thailand, the Ukraine and most former Soviet Bloc countries, including Hungary, Poland, Yugoslavia and the Czech republic also produce hemp. Major hempgrowing countries today include China, France, Holland, Hungary and Russia. Although banned for commercial cultivation, Australia, Canada and Germany allow selected farms to grow hemp for research purposes whilst currently restricting general, local production. In the EC, hemp farmers are allowed to grow strains certified to contain 0.3% THC (tetrahydrocannabinol) or less. Hemp seed is licensed for export; France is a major supplier of seeds for these low-THC varieties.

As far as the European Community Agricultural Policy is concerned, hemp subsidies are available for both hemp fibre and the seed. Some individual countries are discussed below.

Australia

In 1991, Australia began growing hemp for paper; but with the exception of carefully monitored research projects, hemp cultivation is banned. There is a significant industrial lobby for legalisation, noticeably in Tasmania.

Canada

Like the US, Canada was a major hemp farming nation until the late 1930s when this was prohibited. Legislation to permit the widespread cultivation of industrial hemp

has now been introduced. Processing and manufacturing plants and retail outlets for imported, hemp-derived goods already exist.

China

China has been growing hemp, unabated for the last 6000 years and has a vast internal market for hemp products. It is currently the biggest exporter of hemp paper and textiles in the world.

France

France granted its first licence for hemp production in 1960. In 1994, it produced in excess of 10,000 tons of industrial hemp. Experimental, lightweight cement ('Isochanvre') has been produced by combining hemp fibre with lime. Some 300 houses have been constructed of this material and insulated with a hemp fibre at a price which is claimed to be comparable with conventional building materials.

Germany

Hemp cultivation was banned in Germany in 1982; however experimental crops have been produced recently under licence. The fibre has been used to manufacture rope, textiles, cigarette papers and the hurds have been incorporated into composite board and insulation material. Production processes based on imported hemp are at advance stages of development and in 1994, sales for hemp products exceeded DM20 million. Interest among German farmers in the reintroduction of local hemp farming is increasing.

Holland

Local production for paper is being evaluated by the Dutch government and cultivation is increasing, in parallel with the development of processing equipment.

Hungary

Hungary was a major cultivator and supplier of hemp products to the former Soviet Union and still exports widely. Products include upholstery, heat insulation, interior decoration and packaging materials. Hemp-based textiles are widely exported to many countries, including the United States.

Poland

Poland currently grows hemp for fabric and manufactures composite boards for the construction industry.

Romania

Currently the largest source of commercial hemp in Europe, Romania has devoted greater than 40,000 acres to hemp cultivation. Much of the crop is exported to Hungary for processing (see above) prior to re-export to Western markets.

Russia

The former Soviet Union was the largest cultivator and exporter of hemp in the world. Indeed, the Vavilov Scientific research Institute in St Petersburg still holds the largest hemp seed collection in the world, including many rare species not found in other seed banks. Today, Russia consumes most of its own hemp products including rope and CAF (compressed agricultural fibre) board.

Spain

This country exports hemp pulp for paper (notably for cigarette papers and bibles) and produces rope and textiles for domestic consumption.

Ukraine

This state has large quantities of hemp growing wild and harvest of this resource is under way. Farming permits have also been issued.

United Kingdom

The early 1990s saw new agricultural initiatives in Europe, to investigate sustainable alternative crops to alleviate the food mountains being produced on the farms of Europe. As a result of a Home Office lobby by some UK farmers, the first licences for growing hemp with a low THC content were granted in 1992/1993, under the ruling that the crop was being grown for 'special purposes' or 'in the public interest'. The number of farms cultivating hemp is still small, but paper and textile markets are being developed, with government aid aimed at developing new markets for natural fibres, including hemp and flax. In June 1996, some 6,000 hectares were cultivated (compared to 1,482,000 which were designated as set-aside to preserve the status quo). This represented a small start indeed; the majority of the raw hemp processed in the UK is still imported, mainly from China and Hungary.

United States

Although the cultivation of hemp has been actively discouraged in the past, there is a growing demand for textiles and other products made from more environmentally friendly, 'biosustainable' crops than cotton or wood. With the exception of the flowers, leaves, hashish resin and fertile seed, it is legal to import raw hemp products for processing. The number of companies manufacturing hemp products from imported hemp fibre has mushroomed in the last five years so that at present, there are over 200 companies offering a wide range of hemp products in a multi-million dollar business. In this environment, legislative attitudes to local hemp cultivation may change.

SUMMARY

The annual world paper requirement has risen from 14 million tons in 1913 to 250 million tons in the 1990s. Many argue that this cannot be sustained, even with a

significant increase in paper recycling, and that alternative sources of fibre must be found. In 1994, October 26th, the London Financial Times reported that “...fibre hemp...is making a comeback in Europe and the US as an ecologically friendly raw material for clothing and paper”.

It is true to say that at present, most hemp markets are in their infancy. Even with the advent of facilitating legislation, hemp is a crop which is unfamiliar to most farmers and even in developed countries, farm machinery will have to be adapted, or designed from scratch, in order to tend and harvest large-scale plantings. One could liken hemp to an ageing but accomplished and versatile actor, waiting in the wings to give a vintage performance; but at the same time, ready to take to the stage with a few, varied and perhaps, surprising new roles, some of which may be written with this particular performer in mind.

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Hemp Product Producers around the World

BACH (Business Alliance for Commerce in Hemp), P.O. Box 71903, Los Angeles, California 90071-0093, USA.

Hemp Industries Association, P.O. Box 9068, Chandler heights, Arizona AZ 85227, USA.

Hemp Union, 24 Alnaby Road, Hull HU1 2PA, England.

Hemptech—Industrial Hemp Information Specialists, P.O. Box 820, Oja, California 93024–0820, USA.

International Hemp Association, Postbus 75007, 1070 AA Amsterdam, The Netherlands.

International Kenaf Association, P.O. Box 7, Ladonia, Texas TX 75449, USA.

Isochanvre, Le Verger, F-72260, Rene, France.

The Internet

A single search engine revealed the presence of over 200 websites devoted to the cultivation of hemp and hemp products. This illustrates that the interest in this area is truly international and the reader is encouraged to consult this resource for further information.