Last updated: **20th September 2002**

HEMP

Family: *Cannabaceae*

Genus: *Cannabis*

Species: *sativa*

www.freshangles.com/realtime/science/articles/21.html http://www.nf-2000.org/secure/Fair/S658.htm

Contents

General Background

Details of Quality Characteristics

Current Production and Yields

Constraints upon Production

Markets and Market Potential

Other Information

Research

Useful Websites

BioMat Net

Contacts

References

General Background

Names: Fr.: Chanvre; It.: Canapa; Sp.: Canamo; Ger.: Hanf; Dtch.: Heenep; Dan.: Hamp; Gr.: Kannavi; Russ.: Konoplya; Yug.: Konoplja

Hemp is an erect, slender, rather tender dioecious annual herb growing up to 4m tall. Stems and leaves are finely hairy with alternate leaves, palmately divided into 3-11 lanceolate toothed leaflets. Male flowers are similar to those of hops, yellow-green, up to 5mm in diameter, borne in small panicles. The female plants are a darker green, with denser foliage and tightly bunched panicles. They are longer lived, to about 1 month after pollination until seeds are ripe. The flowers are closely surrounded by tubular bracteoles. The female axillary leafy clusters do not form any compact strobilus. The fruiting body is greyish-brown in colour and about 4 mm long. Thousand Grain Weight (TGW) is 200 grammes [1].

Hemp is one of the highest yielding and least intensive crops to cultivate. It is highly selfcompatible so that there is no need for crop rotation, but is also a sound crop rotation. It oppresses weeds well and is so fast growing that it does not require any kind of herbicide treatment. Hemp is also used in breeding nurseries for preventing outcrossing of other crops because of its tall, fast growing stature, thus having good properties as an isolation crop.

Hemp has a wide range of potential uses (Figure 1), since fibre, pith, seeds and seed oils all have ready, and to a degree unique, market niches. Hemp was not cultivated in the UK until 1994; it was in cultivation in some European countries up to the 1950's [1].

Details of Quality Characteristics

Fibre from hemp is suitable for paper-making, cigarette papers, printing and could complement/replace wood pulp. In the past it has been used in production of clothes and ropes too. It is reported to be the longest and strongest of the natural fibres.

Hemp is cut when the male plants are in full flower and shedding pollen. The subsequent retting and scutching processes are similar to those for linseed and flax. Fibre quality is reported as high: 4-20% lignin in comparison with tree wood fibres at over 30% lignin. Lignin

content is significant because it is positively correlated with paper yellowing; a clearly undesirable characteristic for paper with long anticipated life. The traditional methods of bleaching to prevent yellowing are becoming environmentally questioned [2].

The seed contains 30-35% oil, rich in C18:2 and C18:3, which has a number of industrial and food applications [3].

Current Production and Yields

Country	Area harvested '000ha	Yield kg/ha fibre
Bulgaria	0.008	(?)
France	8.200	687.5
Germany	3.0	(?)
Hungary	2.00	1800-2000
Poland	0.1	714.3
Romania	1.3	6153.8(?)
Spain	1.5	4333.3(?)
UK	2.0	5000-7500

Source: FAOSTAT Statistical Database Results 2000 http://apps.fao.org

Estimates of approximately 7.5 t/ha of air-dried stems have been suggested.
(The hemp production for industrial use in the UK in 2000 was 1,600ha and 2,000ha in 2001 (Hemcore 2001))

UK Hemp gross margin comparison

	Hemp	Linseed	Spring Rape
Area aid	277	277	257
Yield (t/ha)	6.2	1.9	1.9
Crop value (£/t)	90	110	130
Return	835	479	504
Variable Costs	403	158	170
Gross Margin	432	321	334

Hemp variable costs include seed £150/ha, fertiliser £80ha, cutting £70/ha, baling £80/ha and haulage £50/ha. Home Office licence is £87/grower for 2001.
UK 2000 hemp subsidy from the EU was paid directly from the Intervention Board at £500/ha, paid on the condition of a minimum yield of 2.5t/ha. See Intervention Board Leaflet CD37. This has now changed and hemp grown for fibre was included in AAPS for the first time in 2001, the direct subsidy scheme administered by the intervention board was discontinued.

Constraints upon Production

The presence of the psychotropic agent THC (delta 9-tetra hydrocannabinol), in fibre hemp, albeit at very low levels, relative to high drug hemp (eg variety Super Skunk) creates drug policing problems and is a limiting factor in its expansion. To minimise this problem, work is in progress to produce cultivars with zero THC, and to develop visual or simple field diagnosis tests for these types. The proscription of the species prevents its production in UK except under license. Misuse of Drugs Act [1971].

For maximum fibre yield it would be ideal to have the option to grow a very late flowering hemp variety, but unfortunately, such an approach would not comply with EC regulations on seed formation, prior to harvest. Current EU approved varieties are restricted to French sources, limiting crop improvement. A range of harvesting processes are being developed to meet the needs of individual countries.

Markets and Market Potential

Awareness of hemp fibre is increasing rapidly and a large range of hemp products are now becoming available. Part of the reason for the comeback of hemp is the variety of raw materials derived from the hemp plant – four different non-food materials in all: long bast fibre, medium fibre, short core fibre, and seed oil.

Long fibre has long, strong strands – superior to cotton – that are very desirable for textiles; has anti-mildew and anti-microbial properties that are particularly useful for sails, tarp, awnings and carpets; is biodegradable and serves as an environmentally sound substitute for fibreglass. Medium fibre has low lignin levels that make it ideal for paper and non-woven

applications; shares the bast fibre's anti-mildew and anti-microbial properties, so it is well suited for medical applications and hygiene products, such as nappy and sanitary napkins. Short core fibre is up to twice as absorbent as wood shavings, making it an excellent choice for packaging and animal bedding; serves as a direct, often sturdier replacement of wood in construction materials; blends easily with lime to create a strong yet lightweight concrete or plaster; is biodegradable and serves as an environmentally responsible material for use in manufacturing plastics. Seed oil also has anti-mildew and anti-microbial properties that make it an excellent base for soaps, shampoos and detergents; blends easily with other substances to produce lubricants, paints and printing inks.

The German Aerospace Institute, as well as several German and American automobile companies, have shown hemp's suitability for making auto components such as gaskets, seat covers, floor mats, and interior panelling. A statement from Daimler-Benz notes:

"Hemp fibres have a number of advantages over flax. They are richer than flax and can be cultivated without the use of insecticides. Initial investigations have shown that hemp matches and even surpasses flax in terms of performance potential and promises to be more economical."

Numerous personal care products can be manufactured using the oil extracted from hemp seeds. Research has shown that hemp oil assists the body's natural ability to heal both externally and internally. The essential fatty acids are readily absorbed into skin cells. Because hemp oil can help restore and moisten skin it is becoming popular for use as massage oil and in lip balms, soaps, shampoos and lotions.

Fibre composites, the fastest growing segment of the wood-products industry, comprise the largest potential market for industrial hemp. Composites include panelling, medium density fibreboard, plywood trusses, and support beams. Hemp can be substituted for wood without changing existing production equipment. Hemp can also be processed into a variety of insulation products that are safer than fibreglass and easy to install. A cement-plaster-like material can be made from a combination of hemp hurds (short, core fibres) and lime. The material can be used without further additives in foundations, walls, floors and ceilings and for interior and exterior plaster. It is stronger than concrete, yet five times lighter, and has excellent insulation and fire-retardant properties. It is also resistant to insects and mould.

Until the 1930's hemp oil was one of the major ingredients of resins, paints, shellacs and varnishes. As a more environmentally responsible material than present day mineral oils it is hoped that hemp oil will again become the ingredient of choice.

Hemp has a fibre yield per acre several times higher than that of trees. Hemp's long and tough bast fibre, while requiring cutting prior to paper making, can produce high quality papers for books, magazines and stationary. The shorter core fibres blended with another long fibred pulp can be used to make newspaper, tissue and packaging materials. There is a potential for hemp substitution at 4,000tonnes per year rising to 8,000 tonnes per year. Currently there are 31 mills throughout the world taking hemp, of which 3 are in Western Europe. Those in France and Spain are adequately supplied locally.

Hemp can be used to manufacture a variety of plastic products. The hurds (short core fibres) may be processed into cellophane packing material or into a low cost, compostable replacement for polystyrene. Several German companies are now developing 100% hemp cellulose plastic composites for the manufacture of snowboards and skateboards. An Austrian company, Zellform, has created a hemp plastic resin called Hempstone for use in musical instruments, loudspeakers and furniture. Plant based plastics from hemp can be completely biodegraded. In the EU annual consumption for packaging uses includes 12 million tonnes of paper and board, 6 million tonnes of plastics and 10,000 tonnes of polystyrene.

Hemp textiles offer a multiplicity of fabric uses: for bedspreads, blankets, backpacks, carpeting, clothing, draperies, hats, luggage, mattresses, sails, sheets, shoes, shirts, tents, towels and upholstery, to name only a few. Hemp textiles have a number of distinct advantages over other fabrics. Compared to cotton fibres, hemp fibres are longer, stronger, more lustrous and absorbent and more mildew resistant.

Other Information

Hemp requires a well drained but water retentive soil to optimise yields, minimum soil pH is 5.0. Initial fertiliser recommendations are 80-160kg/ha nitrogen, 800-120kg/ha phosphate and 160-200kg/ha of potash, no further applications will be required. No herbicide is required as the plant smothers out any infestations.

Hemp is sown in April or May, being drilled or broadcast at approximately 100 kg/ha. Regulations require that the crop should be cut after the seed reaches 50% of its final form and size (usually late August). Harvesting at full flower would be preferred from a practical point of view. The crop should be swathed prior to retting, retting time is generally 2 to 6 weeks from cutting depending on weather conditions, and then baled. The swath will need turning at least once to ensure retting is uniform and to aid drying.

Agronomically much data on production already exists and much more could be gleaned from France (Federation Nationale des Producteurs du Chanvre (FNCP); Institute Technique du Chanvre (ITC) and The Netherlands (CABO/DLO), Wageningen; PAGV, Lelystad) [1].

There are 3 bacterial diseases listed in the European Handbook of Plant Diseases as affecting Hemp, and one fungal disease listed: *Septoria cannabis*. Hemp may also be susceptible to both *Botrytis cinerea* and *Sclerotinia sclerotiorum* but it would seem they are likely to be of little consequence [4]. Treatment of the above diseases is neither practical nor economical.

Flea beetle species have been reported as a pest but not in the UK and birds are often a problem at germination and seed set.

Research

Research is being carried out to reduce the problems present with large scale production of Hemp in Europe. Firstly, due to the often late harvesting of the crops dew retting is unreliable. Retting technologies are required or the dependence on the weather needs to be bypassed. Secondly, an efficient harvesting method for hemp is required. Silsoe Research Institute has investigated this problem and attempted to strip the leaves and head away just before the stem is cut. This allows the exposed stem containing the fibre to dry more rapidly [5].

Useful Websites

http://www.defra.gov.uk/farm/acu/research/reports/rdrep12.pdf - Hemp for Europe Manufacturing and Production Systems

BioMat Net

Hemp (Cannabis sativa)

FAIR-0396 - Hemp for Europe - manufacturing and production systems

AIR Programme - Cluster XI - Non-Food Demonstration Projects

AIR1-CT92-0367 - Demonstration of New Harvesting and Breaking-Down Processes for Flax and Hemp Short Fibres

FAIR-PL97-3784 - Optimisation of the production chain for high performance "light natural sandwich materials" (LNS) as a basis for scaling-up

Biocomposites/Boards

Products - Paper/Pulp

Products - Textiles/Fabrics/Geomembranes

Contacts

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References

1. **Gill, N.T. and Vear, K.C.,** (1980) *Agricultural Botany*. 3rd Edition. Published by Gerald Duckworth & Co. Ltd, The old Piano Factory, 43 Gloucester Crescent, London NW1.

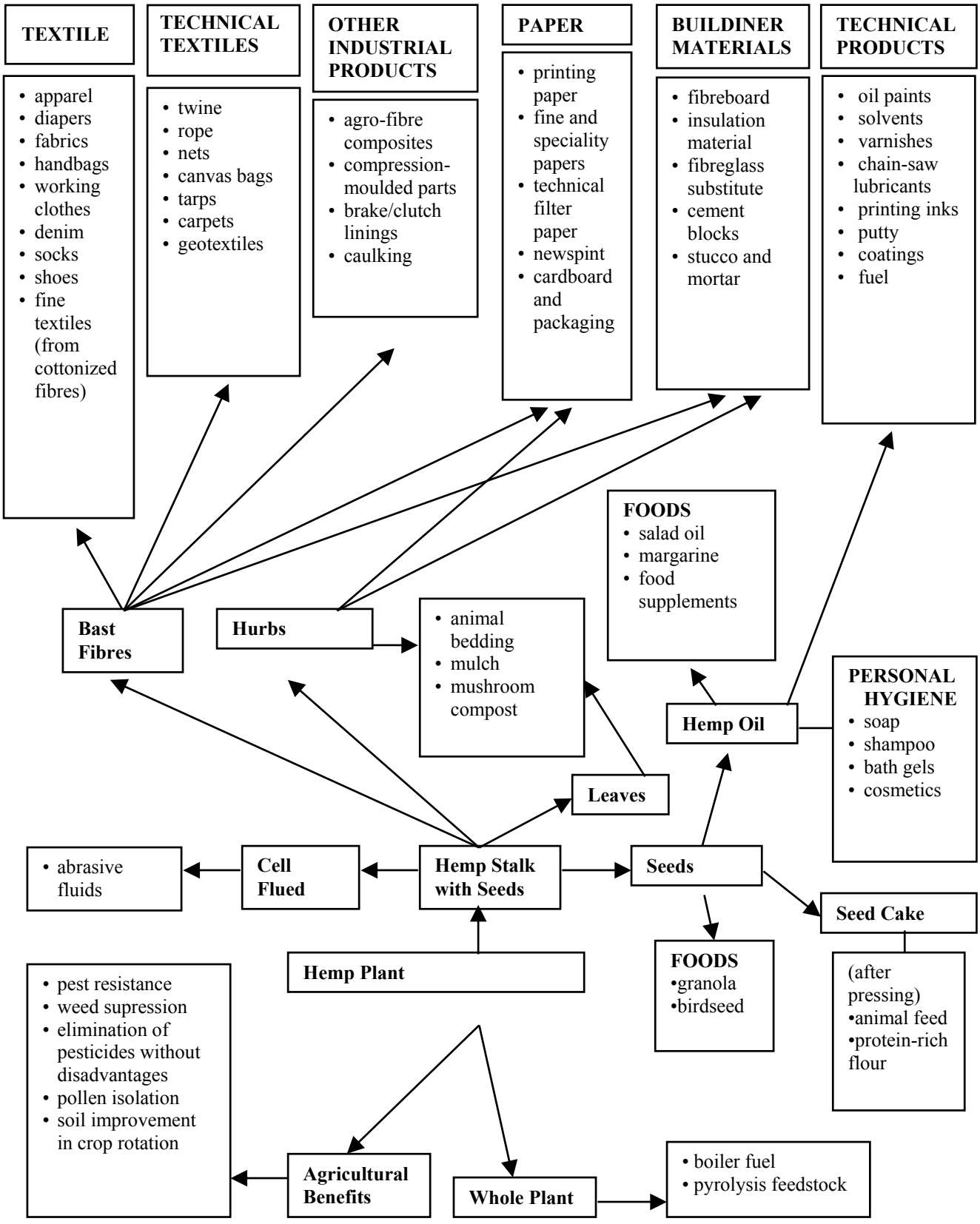
2. **Askew, M. F.** (1992). *A review of novel oilseeds & fibre crops and their potential for the UK.* ADAS Wolverhampton, Woodthorne, Wergs Road Wolverhampton, WV6 8TQ.

3. Toward a UK Research Strategy for alternative crops. Published by Silsoe Research Institute July 1994.

4. **De Rougemont**, (1989). *Crops of Britain and Europe*. Collins: London

5. Ienica Summary Report for the European Union, 2000.

Figure 1. Modern Uses for Hemp [5]



ANNEX I

List of varieties of hemp eligible for aid

Beniko
Bialobrzeskie
Camagnola
CS
Delta-405
Delta-Llosa
Dioica 88
Epsilon 68
Fasamo
Fedora 17
Fedrina 74
Felina 32
Felina 34
Ferimon
Fibranova
Fibrimon 24
Fibrimon 56
Futura
Futura 75
Juso 14
Kompolti
Lovrin
Santhica 23
USO 31