The European Hemp Industry: Cultivation, processing and applications for fibres, shivs, seeds and flowers

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Hemp is a multi-purpose crop, delivering fibres, shivs, seeds and pharmaceuticals. Currently the fibre is used for light weight papers, insulation material and biocomposites. The shivs, the woody inner core of the stem, are used for animal bedding and construction. Hemp seeds, small nuts with a high nutritional value, can be consumed raw or pressed into hemp oil, which has an excellent and unique fatty acid profile. Both seeds and oil are used for human food and animal feed. The non-psychotropic Cannabinoid CBD is an interesting pharmaceutical and food supplement also derived from industrial hemp.
Industrial hemp has been grown in Europe for many hundreds of years. Through the Middle Ages and until the end of the sailing ship period Hemp was an important crop in many European countries including the UK, France, The Netherlands, Germany, Spain and Italy. The most important applications for the strong fibre were canvas for sails and sacks, canvas water hoses and fabrics, as well as ropes.
Today Hemp is a niche crop, cultivated on 25,000 ha in the European Union (2015). Because of its unique properties, particularly its environmental benefits and the high yield of natural technical fibres, hemp is a valuable crop for the bio-based economy.
In the summer of 2012, the European Industrial Hemp Association (EIHA) conducted the first comprehensive survey on cultivation, processing and particularly the applications for hemp fibres, shivs and seeds. It was the most detailed market analysis of European Hemp ever carried out (Carus, M. et al. 2013: The European Hemp Industry:Cultivation, processing and applications for fibres, shivs and seeds, October 2013; www.eiha.org).
In 2015, a survey for an update of the data for the year 2013 was conducted by nova-Institute. In the following report the development from 2010 to 2013 is presented and discussed.

Basic data on cultivation and processing

The survey covers the harvest of 2013, related to a total cultivation area of 15,700 ha. The first figure shows the development of the cultivation area since 1993. Between 1993 and 1996 the cultivation of industrial Hemp was legalised in most of the member states, others followed later. In 2011 the cultivation area decreased to its lowest value since 1994 (ca. 8,000 ha), but increased in 2012, 2013 and 2014, to finally reach 25,000 ha in 2015. In 2016 a further increase is expected. The main cultivation member states are France and The Netherlands. In recent years, many new European countries started or expanded their hemp cultivation, mainly for the production of hemp seeds.

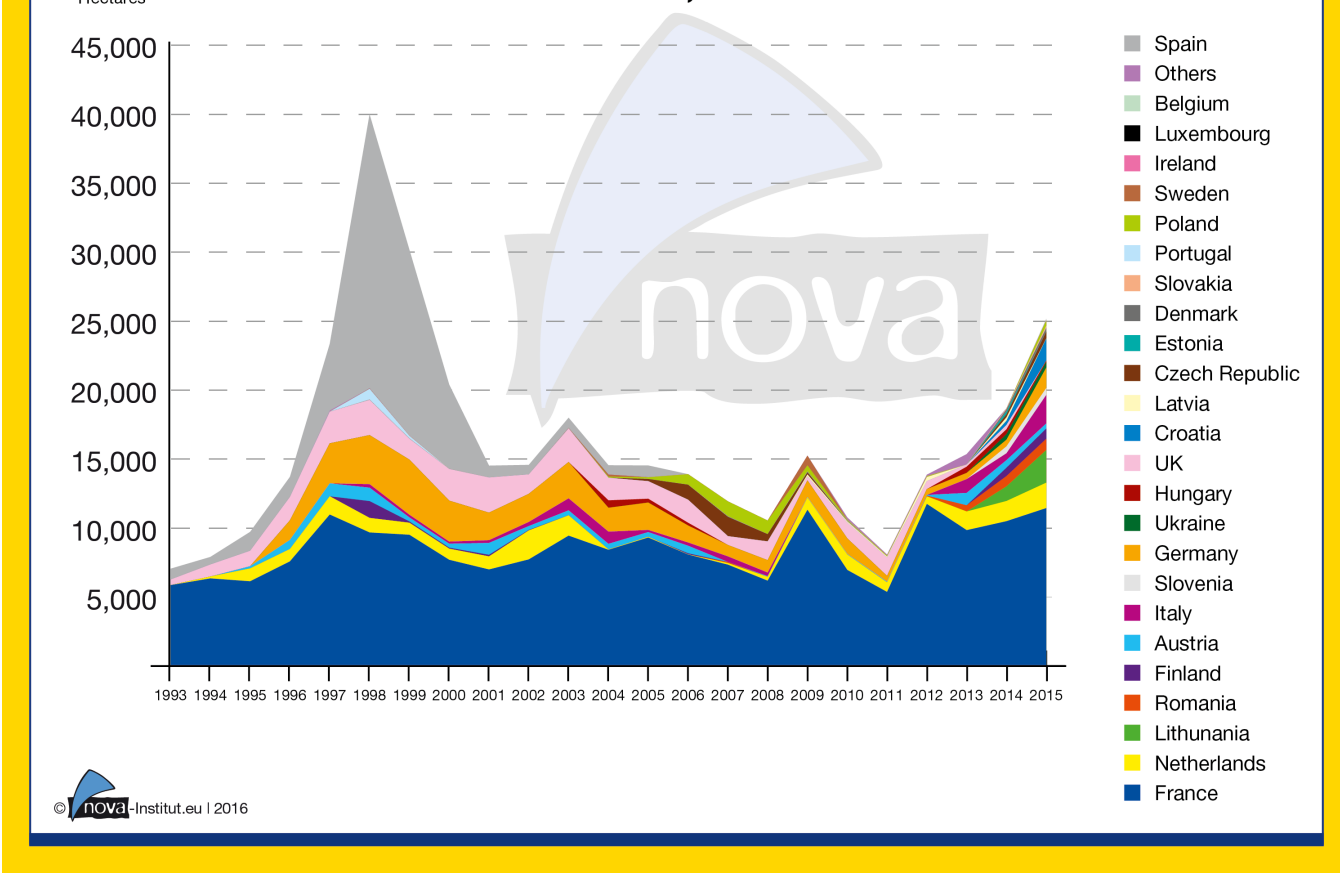

Figure 1: Hemp Cultivation Area in the EU 1993-2015, Source: EU Commission and nova-Institute surveys (nova/EIHA 2016)

From the 15,700 ha in the year 2013, 85,000 tonnes of Hemp straw were harvested and processed to:

- 25,000 metric tonnes fibre
- 43,000 metric tonnes shivs (woody core of the stem)
- The relation between shivs and fibres (shivs : fibres) is of 1.7 to 1
- 13,000 metric tonnes of dust (60% pelletized for incineration, 40% for compost and other uses)

Hemp straw in Europe is only processed in a so called total fibre line, producing random non-aligned technical fibre. This is in contrast to flax, processed in long fibre processing lines, which produces a high value aligned, long textile fibre and a technical short fibre in a similar form to Hemp.

Some companies also or exclusively processed Hemp seeds or Hemp flowers:

- 11,500 tonnes (compared to only 6,000 tonnes in 2010) seeds
- 240 tonnes (compared to only 7.5 tonnes in 2010) of flowers & leaves for medical applications (THC/CBD), food supplements (CBD) and the production of essential oil (for food and beverages)

Whereas fibres and shivs did not show any significant difference between 2010 and 2013, the production of seeds increased by 92% and the production of flowers and leaves by 3,000%. The flowers for CBD production gave hemp farmers a considerable extra profit in 2013.

It should also be mentioned that Hemp is one of the very few crops in Europe that is cultivated on non-organic farms without the use of any agrochemicals. Strong, fast growing Hemp crops are able to supress weeds without chemical support and the crop does not suffer from any pests or diseases that would warrant a spray. Hemp also grows well under an organic regime.

Applications for Hemp Fibres

Hemp fibres have some of the best mechanical properties of all natural fibres. They are mainly used for insulation material and for bio-composites in automotive applications.

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mainly used for insulation material and for bio-composites in automotive applications.
Before the rediscovery of industrial Hemp in Europe in the 1990s, Hemp fibres were mainly (> 95%) used for **speciality pulp & paper**. Because of the high price of Hemp pulp – about five times higher than wood pulp – the applications were limited to cigarette (the main market) and bible paper, technical filters and bank notes. The Hemp pulp and paper market was a relatively stable market in recent decades, but on the other hand there is no market expansion expected and the market is risky because, from a technical point of view, today hemp and flax pulp could be substituted in most applications by a cheaper Kraft wood pulp with specific additives.
In the year 2013 (as in 2010), Hemp pulp & paper is still the most important market for European Hemp Fibres with a share of 57%, supplied mainly by French producers, see Figure 2 and 3 for details.
Due to a lot of research and development in the 1990s financed by the European Commission and the Member States, new applications for Flax and Hemp Fibres were developed, such as biocomposites (mainly automotive) and insulation material and other non-woven applications (technical textiles). **Insulation material** is the second most important application for Hemp fibres today, accounting for about 26% of the applications. **Biocomposites** account for about 14% of the applications.

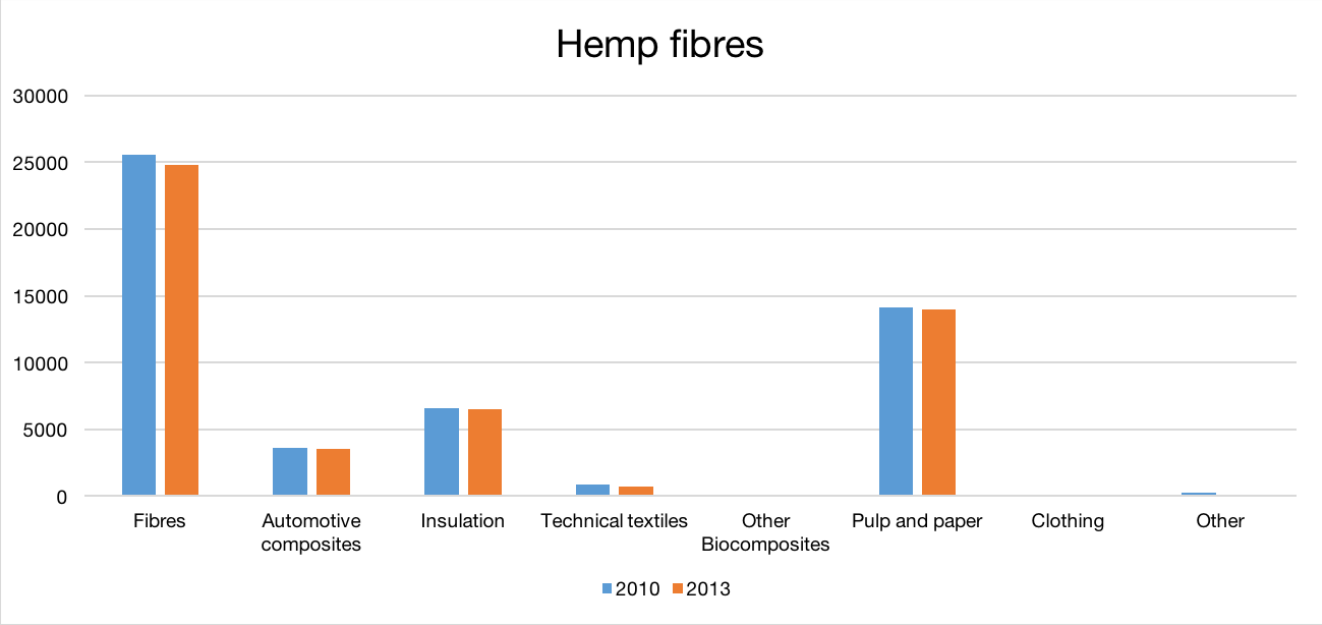

Figure 2: Applications for European Hemp Fibre from harvest 2010 and harvest 2013, in total 26,000 (2010) and 25,000 (2013) metric tonnes (EIHA 2016)

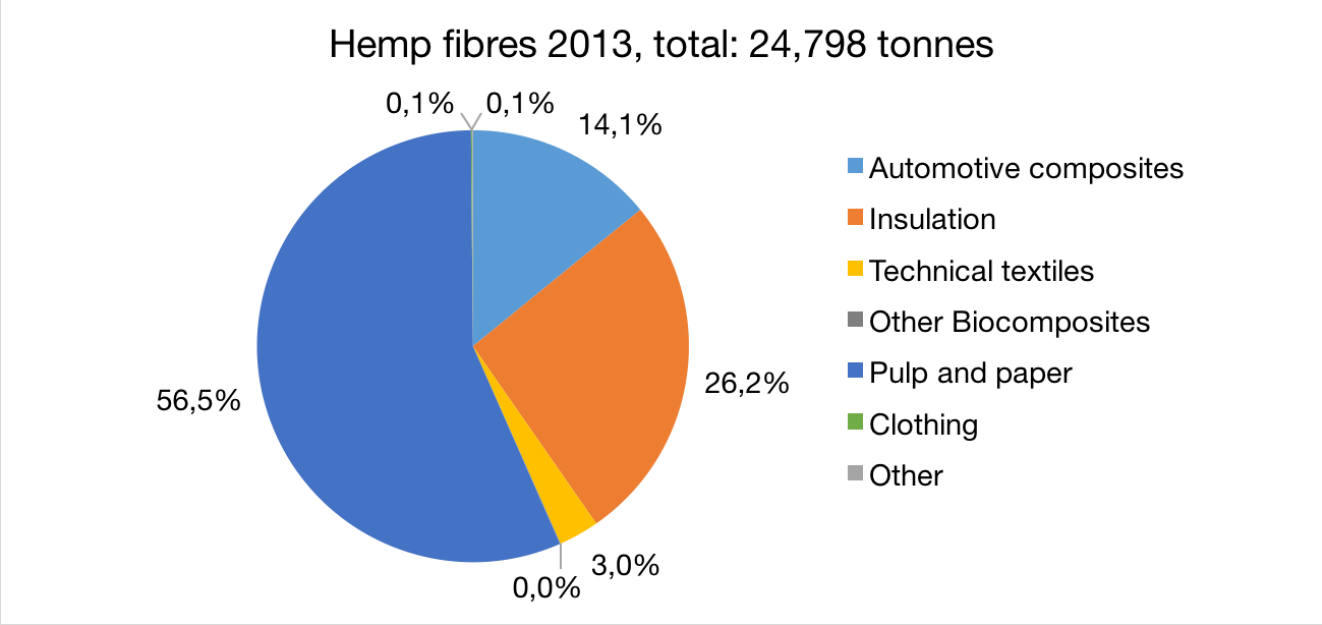

Figure 3: Applications for European Hemp Fibre from harvest 2013, 25,000 metric tonnes (nova/EIHA 2016)

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Today (early 2013) the price range for Hemp fibres starts from about 50 Eurocent/kg for the cigarette paper industry (ca. 25% shiv content) to around 75 Eurocent/kg for automotive and insulation (2-3% shiv content).

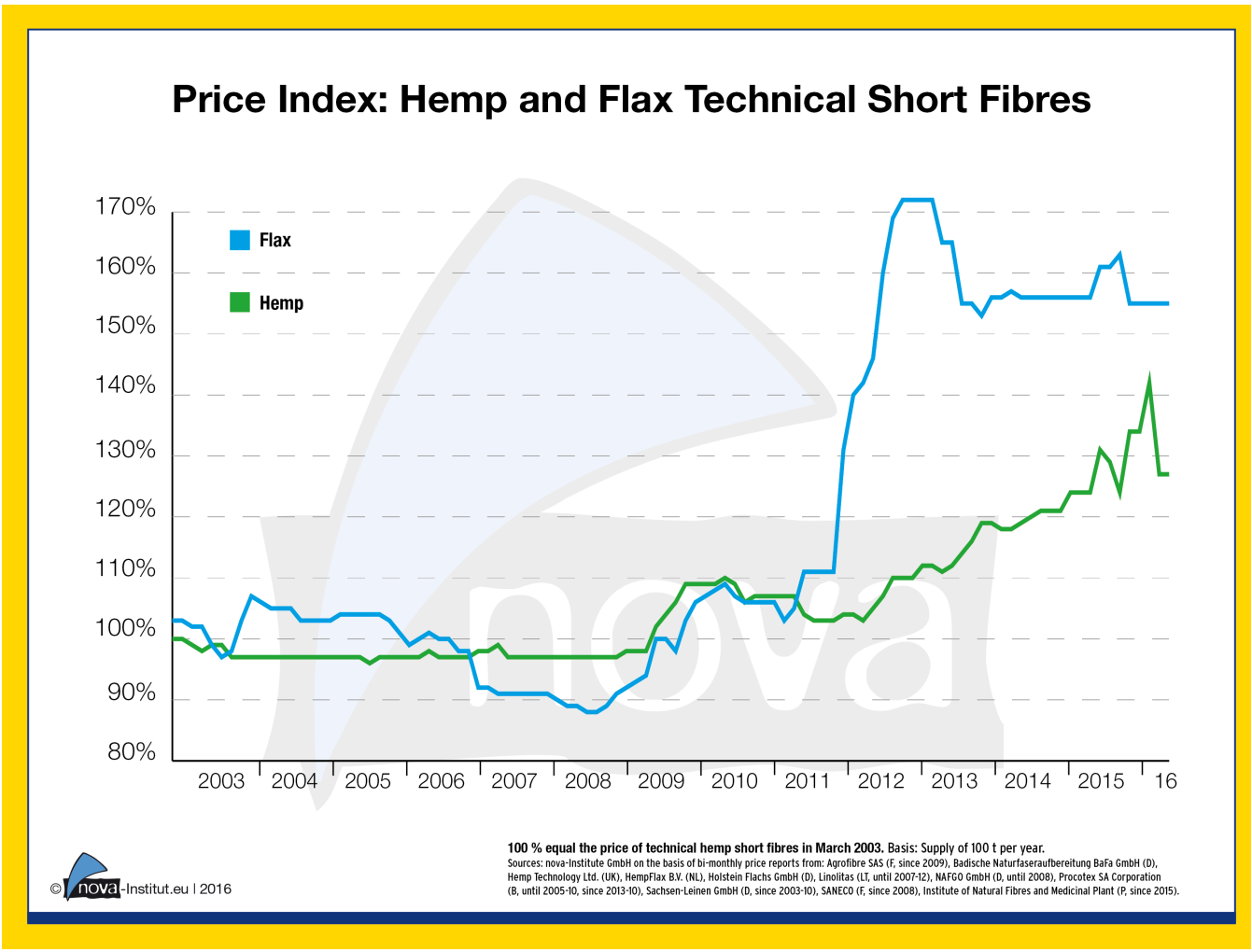


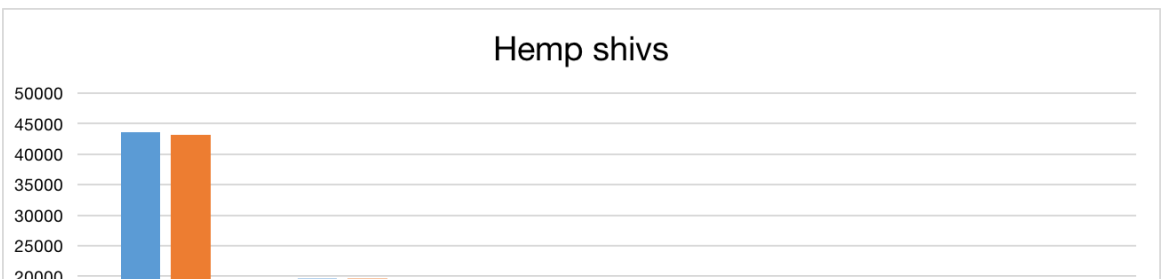
Figure 4: Relative price development for Hemp and Flax technical short fibres from European production 2003 – 2016 (nova 2016)

Applications for Hemp Shivs

In addition to Hemp fibres, the process by which they are extracted (decortication) also produces hemp shivs. From an hemp fibre producer's economic point of view, it is very important to produce clean Hemp shivs to sell into added value markets as for each kilogram of Hemp fibre produced one gets as a by-product 1.7 kg of Hemp shivs.

High performance bedding material for horses and other animals such as chickens is today the most important market for Hemp shivs. Hemp shivs can absorb moisture up to four times their dry weight. They are effective for much longer in the stable or hen house compared to other materials thus saving working time. After use Hemp bedding rots down quickly into an excellent compost.

Of the total Hemp shiv applications **horse bedding** has a market share of 45% and other **animal bedding** 18%, in total 63% of the total Hemp shiv applications (2010 and 2013). An interesting new and increasing market is the use of Hemp shivs in combination with lime for **construction**. Here the market share for shivs is 16%.



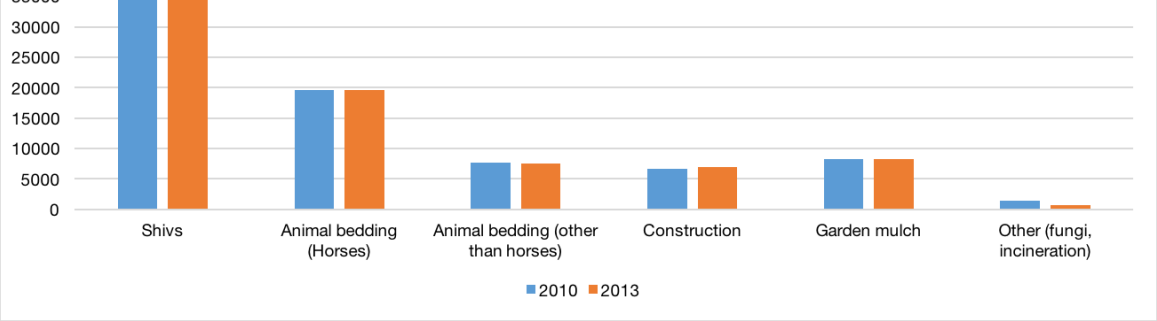


Figure 5: Applications for European Hemp Shivs from harvest 2010 and harvest 2013, in total 44,000 (in 2010) and 43,000 (in 2013) metric tonnes (nova/EIHA 2016)

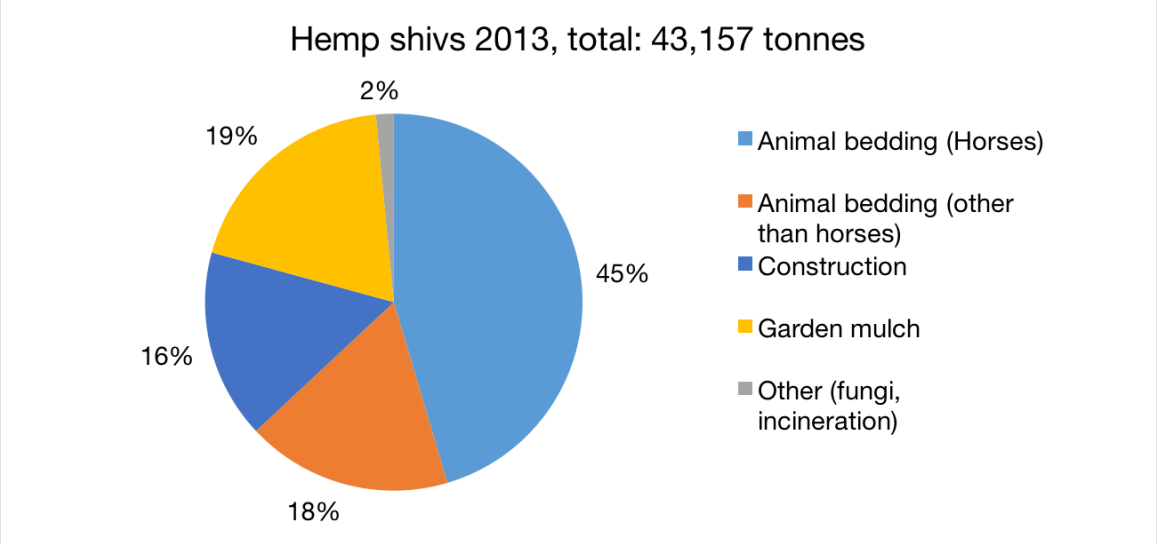


Figure 6: Applications for European Hemp Shivs from harvest 2013, in total 43,000 metric tonnes (nova/EIHA 2016)

Applications for Hemp Seeds and Oil

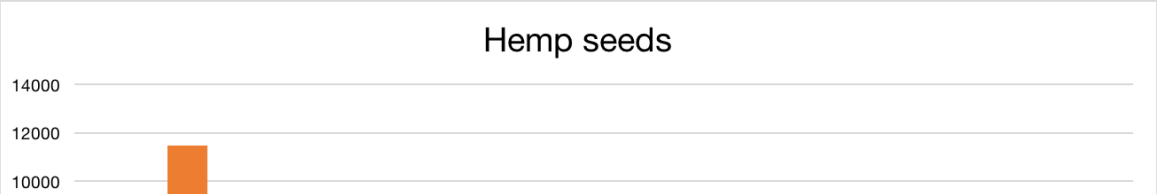
Hemp seeds have been mainly a by-product of hemp crops grown in central or southern Europe for fibre production. Only small areas were used exclusively for Hemp seed production, in contrast to Canada where almost all Hemp is grown for seeds only. But this has changed in the last year, as more and more producers in Europe started to cultivate hemp for seed and flowers production only.

From 2010 to 2013 the production of seeds increased from 6,000 to 11,500 tonnes (92% growth) driven by the increasing demand from the food market. Even big supermarkets started to offer **hemp food products**. Example of this are in Germany and in The Netherlands.

For the first time, more than 50% of the hemp seeds went to the food market (exactly 55%) in comparison with 30% in 2010. The whole market is increasing, but also the share covered by European production.

Bird and fish feed is the main market for Hemp seeds in **animal nutrition**. Both birds and fish need fatty acids with a high share of omega-3 and omega-6 fatty acids for optimum development. The Hemp oil is mainly used to mix with protein feed for Koi Carp.

Hemp seed is an excellent source of several critical mineral nutrients and vitamins. Its oil has an outstanding fatty acid spectrum. It has unusually high 90% unsaturated fatty acids like Linoleic acid (omega 6, essential), Alpha-linoleic acid (omega-3, essential), Gamma-linoleic acid (omega-6). Its protein is balanced and easily digested. Its nutritional composition and culinary versatility is very much in line with several major trends in the science and marketing of food. With the right quality management and marketing, the use of Hemp seeds and oil in healthy human nutrition will continuously expand.



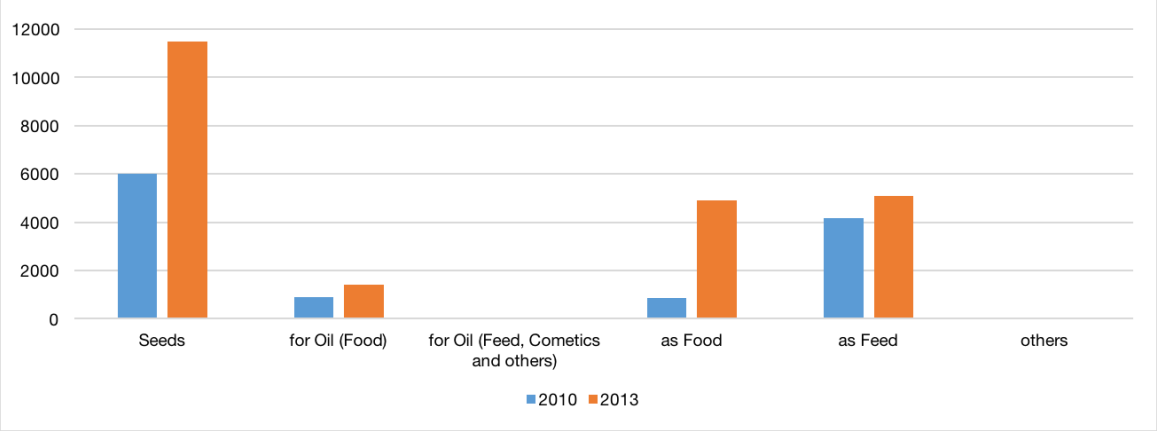


Figure 7: Applications for European Hemp Seeds from harvest 2010 and harvest 2013, in total 6,000 (in 2010) and 11,500 (in 2013) metric tonnes (nova/EIHA 2016)

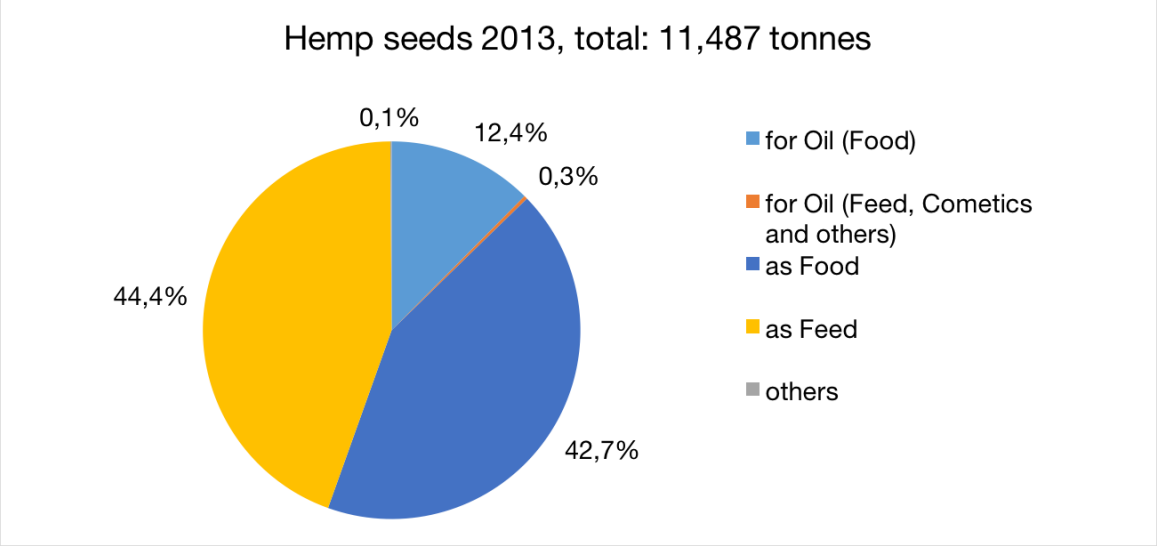


Figure 8: Applications for European Hemp Seeds from harvest 2013, in total 11,500 metric tonnes (nova/EIHA 2016)

Cannabidiol (CBD)

Very recently CBD has increasingly gained prominence in the **pharmaceutical** and **food supplement** industries. CBD can be easily extracted from the flowers and leaves of industrial hemp as a high value by-product. In 2013, 240 tonnes of flowers & leaves for medical applications (THC/CBD), food supplements (CBD) and the production of essential oil (for food and beverages) were produced compared to only 7.5 tonnes in 2010. This means an increase of 3,000% from 2010. Further growth is expected in the next years.

For more information, please go to www.eiha.org

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