

Exploring the potential of value chains for Sicilian hemp-based food products

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Sicilian Hemp field (Photo: Nino Virzi, CREA)

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Introduction

1. Context

DiverIMPACTS is a multi-actor European project bringing together scientists, farmers, farmers' organisations, associations from eleven European countries to collaborate on the promotion of diversification (<https://www.diverimpacts.net/>). Twenty-five concrete innovation case studies are at the core of this project. One of these case studies is taking place in Sicily, led by FIRAB in collaboration with CREA.

The Sicilian case study under the EU project DiverIMPACTS aims at supporting farm profitability while enhancing biodiversity, soil fertility and reducing inputs use through more diversified cropping systems. To reach that goal, developing the production of hemp was identified as a potentially relevant opportunity.

Some Sicilian farmers involved in the case study have started experimenting the production and processing of hemp for a few years, making hemp products (mostly oil and flour) that are mainly sold in niche markets promoting local and healthy food. The potential development of marketing channels for hemp-based food products from Sicily still need to be explored in order to know in which extent hemp production can be promoted and developed.

To support this innovation dynamic, a study on the potential of value chains for Sicilian hemp-based food products was rolled-out in March-June 2019 by the UCLouvain University (Belgium partner of this European project) in collaboration with FIRAB and CREA.

2. Objectives and focus of the study

This study mainly focuses on the potential of value chains for **hemp-based food products**, and especially on products for which Sicilian farmers have the opportunity for and are interested in managing the whole value chain: **hemp oil and flour**.

Among the variety of uses that hemp has, hemp oil offers a high nutritional value and is getting interest from a gastronomical and nutraceutical point of view. Integrating hemp flour in pasta making also seems to be interesting from a nutritional point of view and food diversification. Additional opportunities exist such as blending hemp flour for bread and pastry making or using flowers to complement hop in beer.

The hereby document provides information on **marketing opportunities**, through a benchmarking of hemp-based food products and pricing in a number of EU countries, marketing positioning and the possibilities of nutritional claims, and an analysis of relevant processing and market development in Sicily. We mainly refer to **organic products** as the case study actors involved operate under organic certification.

Preamble: industrial hemp production worldwide

1. Products obtained from hemp

Hemp offers a wide variety of uses, both from straw, seeds and flowers (Figure 1).

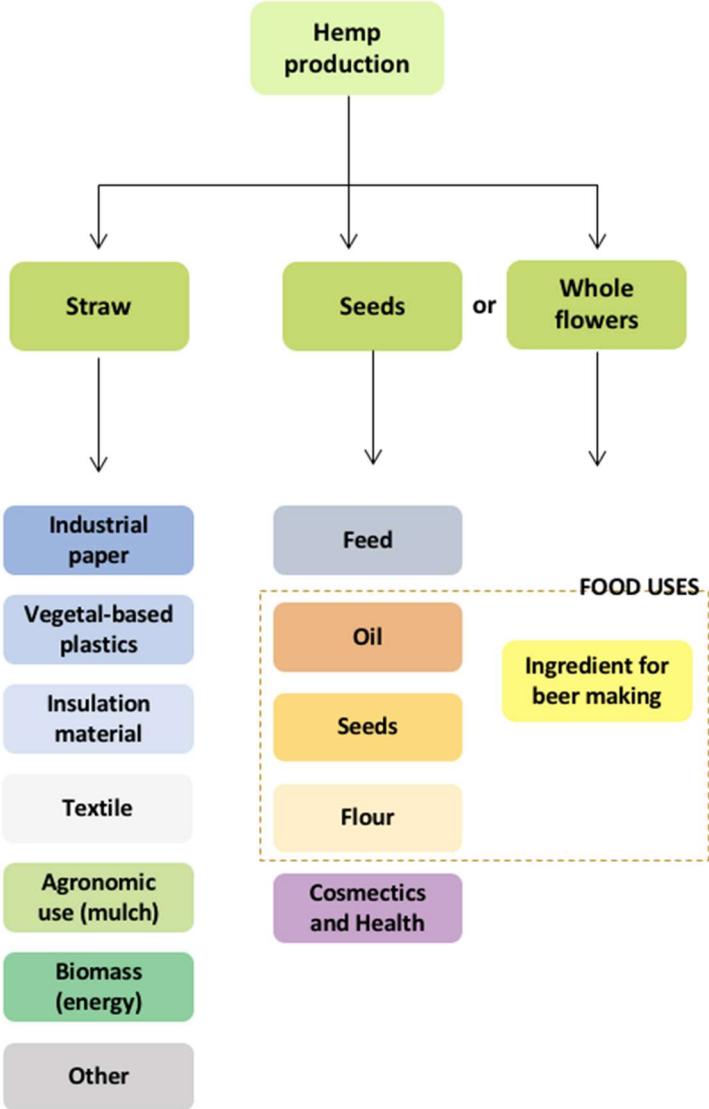


Figure 1: Uses of hemp straw, seeds and flowers

The illustration is not necessarily exhaustive: new uses of industrial hemp are regularly discovered and promoted. As an example, the essential oil from industrial hemp by-products was identified as an effective tool for insect pest management in organic crops (Benelli et al. 2018).

2. Hemp acreage and markets worldwide

Worldwide acreage of industrial hemp in 2016 is estimated about 100,000 ha. The first producer is China (45% of worldwide hemp acreage), while Europe has 33% (Figure 2). Hemp-based Foods can be purchased in supermarkets, convenience stores and others. The most proportion of Hemp-based Foods is distributed in supermarkets, the proportion in 2016 was 46% (Pioneer reports 2019). In 2017, the global Hemp-based Foods market size was 420 million euros¹ and is forecasted to 2,345 million US in 2025, growing at an annual growth rate of **24% from 2018**².

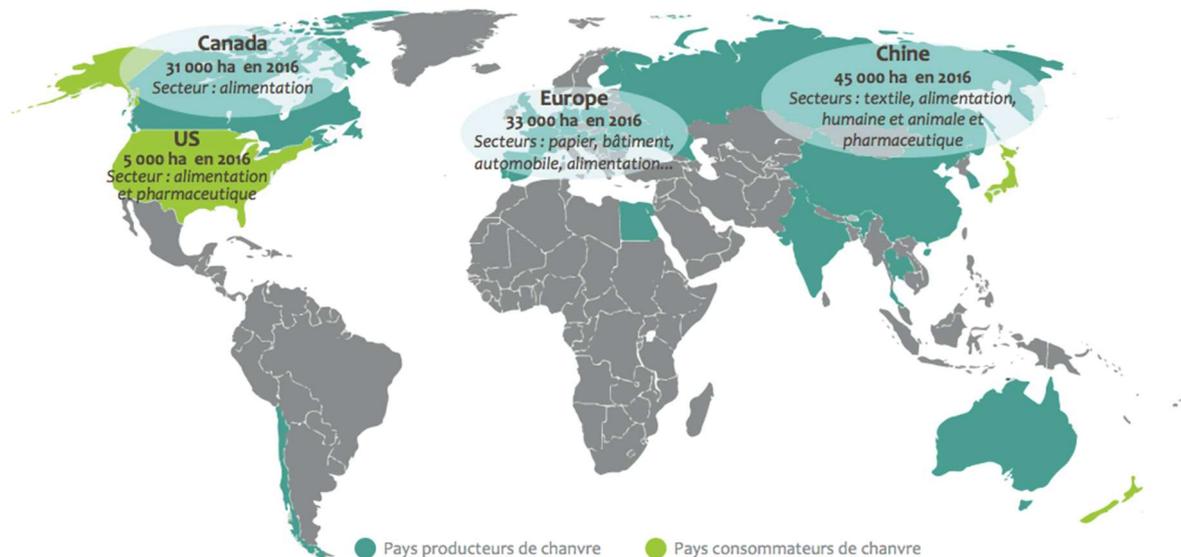


Figure 2: Worldwide acreage of industrial hemp in 2016

Source: (Interchanvre 2017).

3. Hemp acreage at the EU level

At EU level, the hemp cultivation area has been growing fast, especially since 2011, and reached 42,500 ha in 2017 (Interchanvre 2017). The largest producer still is France, followed by Estonia, Lithuania, Netherlands and Italy (Figure 3). In Europe, the seeds have been mainly used for food purposes (about 56% of harvested seeds) and for animal feeding (44% of harvested seeds) (data from 2013³, (EIHA 2017)) (Figure 4).

¹ in comparison, the French market is estimated at 3.5 million euros of sales in 2016 in organic stores (large retailers and direct sales not included) (Plan Filière de l'interprofession du chanvre, 2017).

² Source: QY Research. Global Hemp-based Foods Market Insights, Forecast to 2025.

³ No more recent data could be obtained along the study. It must be underlined that uses have been rapidly changing: in 2012, feed and food uses were respectively estimated 70% and 30%. This shows that food uses grew fastly. Since 2013, the repartition of uses much likely changed, including through the development of cosmetic and health uses.

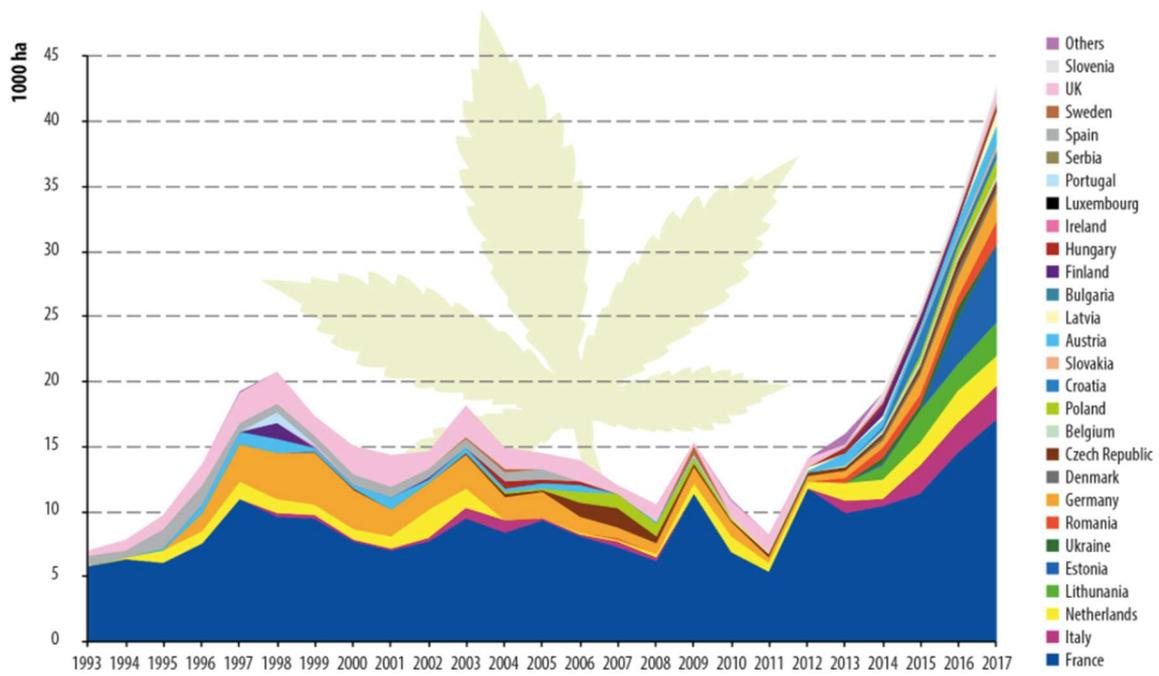


Figure 3: Evolution of the hemp cultivation area in EU countries from 1993 to 2017 (EIHA)

Source: (EIHA 2018).

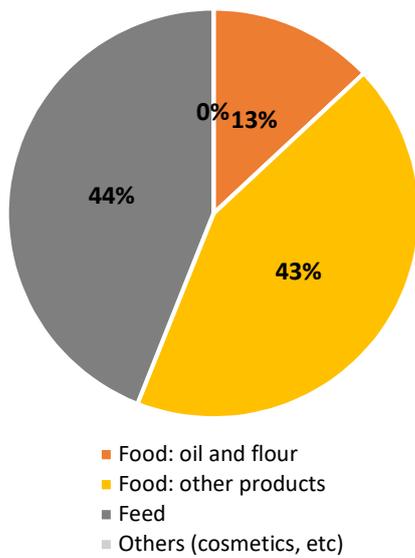


Figure 4: Uses of hemp seeds in EU in 2013

Source: (EIHA 2017)

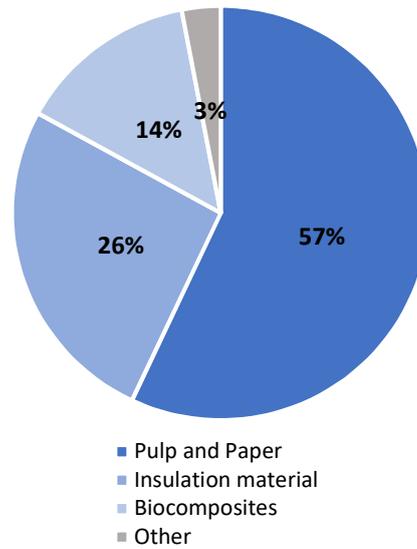


Figure 5: Uses of hemp fibers in EU in 2013

Source: (EIHA 2017)

4. Hemp acreage and production in Italy

Hemp cultivation in Italy

At the EU level, Italy is among the medium players (Figure 3). The acreage has been growing fast: according to recent estimates over 4,000 hectares of hemp were sown in 2018, about 3,000 ha in 2017, while the acreage of hemp was estimated around 1,000 ha in 2014 and 400 hectares in 2013 (Table 1)⁴.

Table 1: Hemp cultivation area in Italy and its share at EU level from 2013 to 2018

	Hemp cultivation area ¹ in Italy (ha)	Hemp area in the EU (ha)	Share of Italy in the EU hemp area (%)
2013	400	15.700	2,5%
2014	1.000	17.500	5,7%
2017	< 3.000	42.500	< 7,1%
2018	4.000	not yet available ⁵	

Notes:

¹ approximate figures.

Sources:

- Hemp cultivation area in Italy in 2013, 2017 and 2018: (Canapaindustriale.it 2018);

- Hemp cultivation area in Italy in 2014: (EIHA 2014)

- EU hemp area: (EIHA 2017) ; (EIHA 2018).

Hemp cultivation in Sicily

In Sicily, the area dedicated to hemp cultivation is estimated around 500-600 ha in 2019⁶ (Figure 6). This is only 0,03% of the regional agricultural area⁷, but shows a rapid growth since 2016. Actors estimate that about 500 ha are cultivated under contract for para-pharmaceutical uses⁸ while about 100-200 ha are cultivated for food production (mainly for making oil and flour)⁹; ¹⁰. There are diverse processing units in Sicily for oil extraction, substance extraction, industrial materials, insulation materials, biomass for energy use (Figure 11 in appendix).

⁴ The growth in recent years can be related to law 242/2016 after which the hemp acreage rapidly grew in Italy.

⁵ Data for 2018 will probably be released on occasion of the 16th EIHA Hemp Conference, 5–6 June 2019. The European Industrial Hemp Association has launched a survey “Status hemp 2018” on cultivation figures, raw materials and applications.

⁶ This is according to unofficial sources and it is based on operators’ guesstimates and assumptions

⁷ The agricultural area is 1,7 million hectares (Wikipedia).

⁸ Especially under contract with Canopy Growth Corp: <https://www.canopygrowth.com/fr/>.

⁹ The two farms that are part of this DIVERimpacts case study respectively cultivate 4 ha and 7 ha on their own land. Considering also surfaces from other farms that they support/to which they provide services, the surface of hemp for food uses at the regional level is estimated 100-200 ha.

¹⁰ In addition, some surfaces that were contracted by Canopy Growth for para-pharmaceutical purposes may not be harvested on time. In this case, grain will be harvested and will probably be processed into oil and flour, leading to a larger production at the regional level.

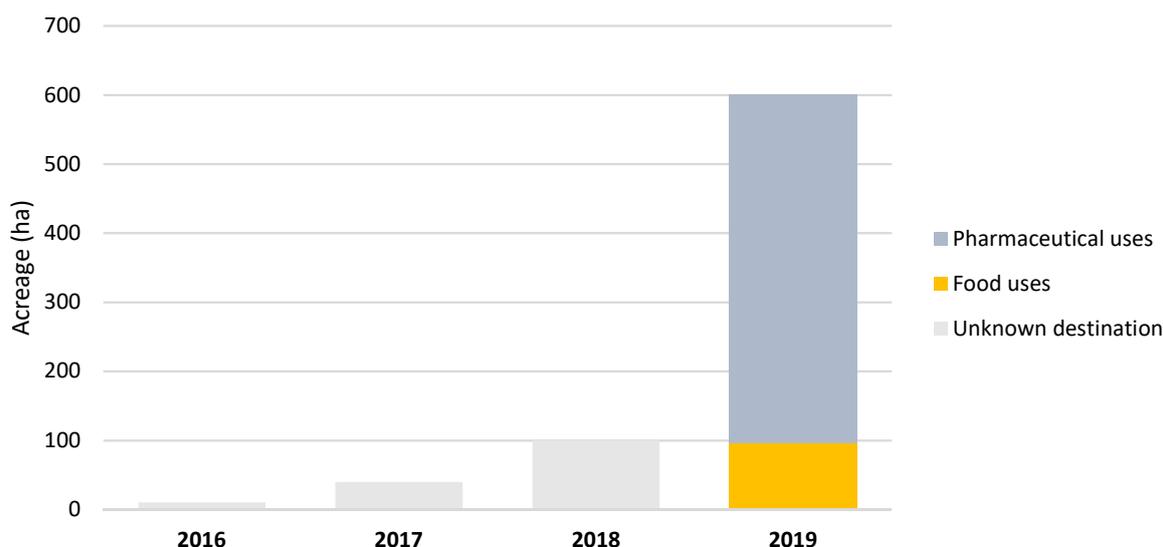


Figure 6: Acreage of hemp in Sicily according to operators' estimates.

The surface dedicated to hemp for food products in 2019 is estimated 100-200 ha according to operators' estimates. In this study we consider 100 ha (conservative assumption).

Specifically, regarding food uses, from 1 ha of hemp, the average production of clean hemp seeds is 400 kg, that may be processed into approximately 80 kg of hemp oil, 300 kg of hemp flour and 20 kg of waste used for animal feeding (operators' estimates)¹¹. At the regional level, from 100 ha dedicated to food production, one can expect 8,000 liters of hemp oil and 30 tons of flour (and 2 tons of waste) (Table 3). After harvest, hemp straw is generally left in fields¹².

Table 2: Estimate processing ratios of hemp seeds for food uses in Sicily in 2019 according to operators' estimates

	Values from 1 ha	Values for 100 ha (acreage in 2019)
Estimated acreage (ha)	1	100
Seeds yield (ton/ha) ¹	0,4	0,4
Estimated production of seeds (tons)	0,4	40
Potential production of oil (liters)	80	8.000
Ratio (liters of oil/kg of seeds)	20%	
Potential production of flour (tons)	0,3	30
Ratio (tons of flour/ton of seeds)	75%	

¹ Clean seeds (in Italian: seme pulito e vagliato). Average yield described by local actors. High inter-annual variability.

¹¹ In (Frascarelli and Meloni 2018), the production estimated from 1 ha of hemp is 0,3 t of clean seeds, that can be processed into 23 liters of oil and 230 kg of flour.

¹² A valorization of the straw may be organized in the future.

I. Benchmark of more mature hemp marketing stories and businesses in other countries

I.1. Objectives and methodology

The objectives of this benchmark are:

- to highlight the diversity of hemp-based products;
- to analyze prices and market positioning of hemp oil and flour in EU markets (especially France, Belgium, Germany, Italy).

This will allow for comparison with current marketing in Sicily.

The benchmark is based on an online review of hemp-based food products pricing and positioning. Four national markets were screened: Italy, France, Belgium, Germany. Data was obtained from at least three products brands/websites in each country.

I.2. A diversity of hemp-based food products

About ten main hemp-based food products are found in the European market (Table 3). Some products are ingredients (oil, flour, seeds) while others are more elaborate products made from hemp seeds or flour: vegetal drinks, beer, desserts, tofu products, etc. Additionally, they are more specific products (powders rich in hemp protein recommended for low-meat food habits and sportive lifestyles, nutritional supplements under the form of tablets, for health and sport, etc.). This is a very dynamic market with regular product innovations¹³.

Table 3: List of hemp-based food products identified

Products	Brands examples	References
Oil	Vigean	(1)
Flour	Hempika	(2)
Dehulled/raw seeds	Yaoh	(3)
Cereals bar	Schalk Mühle	(4)
protein powder	Myprotein.it	(5)
Vegetal drink	Bjorg, EcoMil	(6a), (6b)
Dessert	Sojade	(7)
Beer with hemp	Tiger	(8)
Hemp tofu	iTofu	(9)

References: (1) www.huilerievigean.com; (2) hempika.com ; (3) www.yaoh.co.uk ; (4) www.vitalabo.com/schalk-muehle ; (5) www.myprotein.it, (6a) www.bjorg.fr, (6b) www.greenweez.com/ecomil, (7) www.greenweez.com/sojade, (8) tigerhempbeer.com ; (9) naturalia.fr/i-tofu.

¹³ See for example Canafé (www.canafe.it/it), Hemp cream (www.aziendapalombara.it/products/canapa-ciocc/), etc.

I.3. Marketing of hemp oil

Marketing channels

Hemp oil is found online, in farms and in some organic and mainstream supermarkets. There is no data available at the EU level on the share of each marketing channel.

Prices of hemp oil: an overview

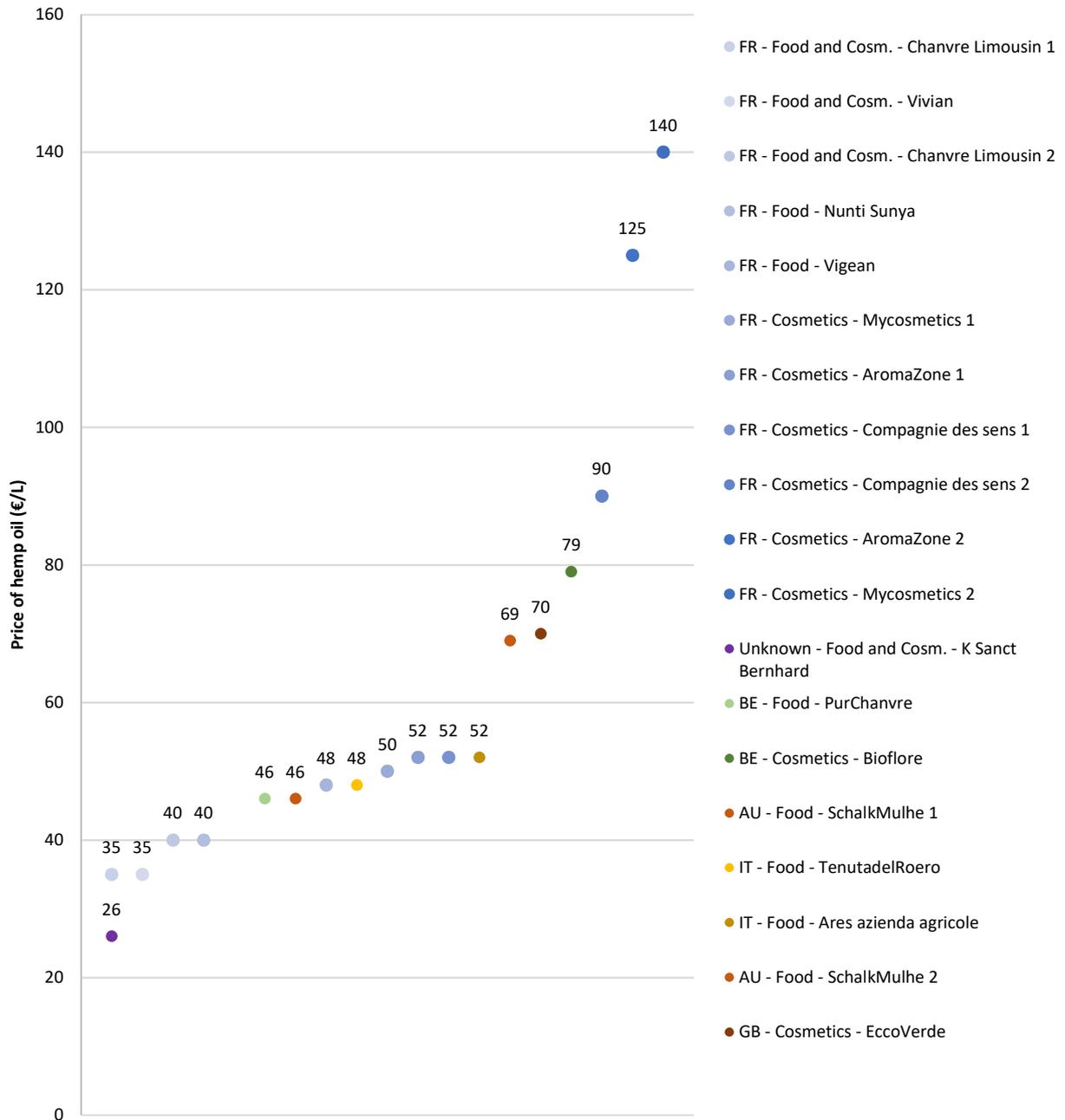


Figure 7: Overview of the prices of organic hemp oil identified through the benchmark (cosmetics and food positioning, online and direct selling, in France, Belgium, Italy and Germany).

Legend: origin of the product, market positioning and brand. For example, "BE - Food - PurChanvre" stands for an hemp oil from Belgian origin, sold as a food product by the PurChanvre brand.

Prices of hemp oil: online pricing

The selling price of organic hemp oil online ranges from 26 € to 140 €/L (Table 4). Prices varies significantly accordingly to the packaging size (more than double price for small packaging in some cases). Hemp oil is sold as a food product, a cosmetic product, or a double-use product. The highest prices are reached through cosmetics marketing. The lowest price (26 €/L) is commercialized by a German retailer while the origin of the oil is not mentioned. The second lowest price, certified from an EU origin, is 46 € and is from Austrian origin (Table 4).

Table 4: Comparison of the price of organic hemp oil - online selling

Positioning	Retailer	Selling country	Origin	Indicative price (€/L)	Packaging (mL)	Product brand
Cosmetics	My cosmetik	FR	FR	50 - 140 €* ¹	50 - 500 mL	My cosmetik
Cosmetics	AromaZone	FR	FR	52 - 125 €* ¹	10 - 250 mL	AromaZone
Cosmetics	Compagnie des sens	FR	FR	52 - 90 €* ¹	50 - 250 mL	Compagnie des sens
Food	Vigean	FR	FR	48 €	250 mL	Vigean
Food	Brussels Gourmet	BE	BE	46 €	250 mL	PurChanvre
Cosmetics	Les ateliers de Gen	BE	BE	79 €	100 mL	Bioflore
Cosmetics	Ecco Verde	IT	GB	70 €	100 mL	Akamuti
Food	Vitalabo	IT	AU	46 - 69 €	100 - 500 mL	Schalk Mühle
Cosm/Food	K. sanct-bernhard ²	GE ³	unknown ⁴	26 €	250 mL	K. sanct-bernhard

Notes: ¹depending on packaging size; ² Kräuterhaus sanct-bernhard; ³ also FR, IT, GB; ⁴ the origin is not mentioned on the product (agriculture UE/non UE).

Websites: www.mycosmetik.fr; www.aroma-zone.com; www.compagnie-des-sens.fr; www.huilerievigean.com; www.rob-brussels.be; www.ecco-verde.it; www.lesateliersdegen.be; www.vitalabo.it; www.sanct-bernhard.fr.

Prices of hemp oil: direct selling from farms

The price of hemp oil sold in farms varies from 30 to 52 €/L (on average 41 €/L) (Table 5).

Table 5 : comparison of the price of organic hemp oil - direct selling from farms

Positioning	Farm	Production and selling Country	Packaging	Price (€/L)
Food/Cosmetics	Vivien Danjou	FR	25 cL	35 €
Food/Cosmetics	Chanvre Limousin	FR	10 cL - 5 L	30 - 40 €
Food	Nunti Sunya	FR	25 cL	40 €
Food	Ares	IT	25 cL	52 €
Average				41€

Websites: www.vivien-danjou.fr; www.chanvrelimousin.fr; www.nuntisunya.com; and www.ares.farm.

Pricing of hemp oil versus other oils with high nutritional value

The prices of organic hemp oil are generally close to prices of nut and hazelnut oils, which all have a high nutritional quality and are appreciated for their specific taste. The pricing of those three oils is differentiated in some cases (e.g. Vigean, France - here hemp oil shows an intermediate pricing, between olive oils and nuts oils) while it is similar in some other cases (e.g. Tenuta del Roero).

Table 6 : Comparison of the price of high nutritional value oils: example of one brand in Italy (Tenuta del Roero, Piemonte)

Products	Origin	Packaging	Price (€/L)	References
Organic hemp oil	IT	25cL	48 €	(1)
Organic nut oil	IT	25cL	48 €	(2)
Organic hazelnut oil	IT	25cL	48 €	(3)

References:

(1) olico.it/it/63-olio-vergine-di-canapa-biologico-8003250003458.html

(2) olico.it/it/60-olio-di-noce-8003250003427.html

(3) olico.it/it/61-olio-di-nocciola-8003250003403.html

Table 7 : Comparison of the price of high nutritional value oils: example of one brand in France (Vigean)

Products	Origin	Packaging	Price (€/L)	References
Organic hemp oil	FR	25cL	48 €	(1)
Organic nut oil	Not specified	25 or 50cL	50 €	(2)
Organic nut oil	FR	25cL	60 €	(3)
Organic hazelnut oil	Not specified	25cL	60 €	(4)

References:

(1) www.huilerievigean.com/p-431-huile-de-chanvre-bio.html

(2) www.huilerievigean.com/p-497-huile-de-noix-bio.html

(3) www.huilerievigean.com/p-499-huile-de-noix-bio-origine-france.html

(4) www.huilerievigean.com/p-434-huile-de-noisette-bio-fair-for-life.html

Overview of quality attributes of hemp oil

Quality attributes identified include:

- taste (generally described as nutty and grassy);
- nutritional quality (content of polyunsaturated fatty acids, see below);
- local character (for some of the products identified in the benchmark);
- farm products, artisanal (idem).

I.4. Marketing of hemp flour

Marketing channels

Hemp flour is found online, in farms and in some organic and mainstream supermarkets. There is no data available at the EU level on the share of each marketing channel.

Quality attributes of hemp flour

Hemp flour is used as an ingredient and has different uses than oil and seeds. Hemp flour description often includes the following aspects¹⁴:

- artisanal product
- organoleptic quality (green color, texture, taste) very relevant for smoothies, pastry¹⁵, etc. allowing for a diversification of recipes
- high protein content
- low carb
- gluten free.

¹⁴ Those aspects were identified in the description of the hemp flour products listed in Table 9.

¹⁵ mixed with cereal flour. The recommended ratio of hemp flour for optimal taste and texture is generally 10 to 20%.

Prices of hemp flour

Prices of hemp flour appear to be ranging from 9 €/kg to 22 €/kg (Table 8).

Table 8 : comparison of the price of organic hemp flour (online and direct selling, in France, Belgium, Italy and Germany).

Brand/Farm	Marketing channel	Selling country	Origin	Packaging	Price (€/kg)
Chez Marie Jeanne	Direct	BE	BE	200 g	22 €
Hello Joya	Online	FR	FR	400 g	22 €
L'Chanvre	Direct	FR	FR	250 g	21 €
JeanJean	Online	FR	FR	350 g	17 €
Rapunzel	Online	GE	EU	250 g	10 €
Ares	Direct	IT	IT	1000 g	10 €
Tibiona	Online	IT	UE	1000 g	9 €
Average					16€

Websites: [HelloJoya](#); [L'Chanvre](#); [JeanJean](#); [Tibiona](#); [Rapunzel](#); [Chez Marie Jeanne](#); [Ares](#).

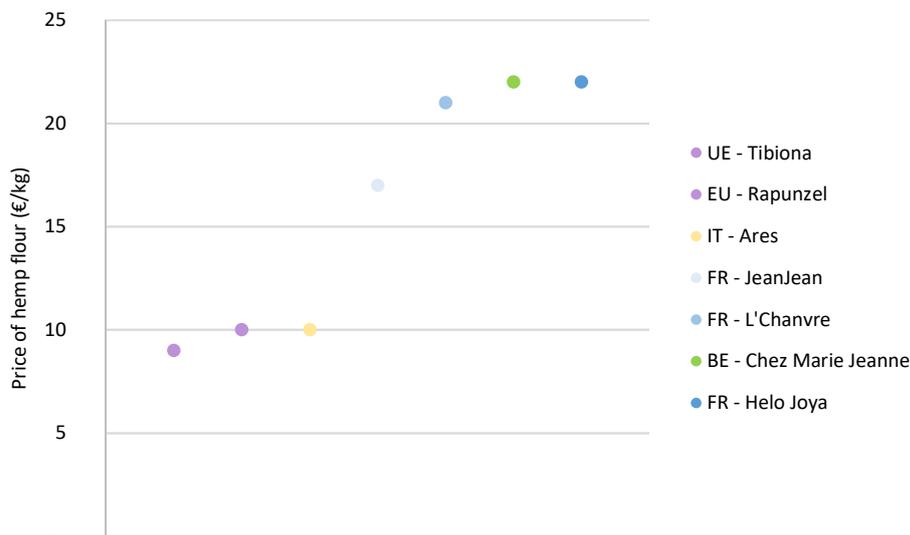


Figure 8: Overview of the prices of organic hemp flour identified through the benchmark (food positioning, online and direct selling, from different origins).

1.5. Key learnings from benchmark

There is a very high diversity of hemp-based food products, with a strong dynamic of product innovation.

Prices of hemp oil range from 26 € to 140 €/L. The average price found in the benchmark is 60 €/L. The lowest price is found for a product on which the origin is not mentioned. Prices in France seem quite similar to the current pricing in Sicily. Oils may be marketed as a food/cosmetics product. Prices are generally higher under cosmetics marketing.

Prices of hemp flour range from 9 €/kg to 22 €/kg, the average price found in the benchmark is 16 €/kg. The lowest prices are found for products on which the origin is not mentioned or products in big packaging.

II. Current and possible marketing positioning of hemp oil in Sicily

II.1. Objectives

The objective here is to analyze the characteristics of the Sicilian hemp oil that could be valuable in the market. Sources of the analysis include the benchmark above mentioned (from France, Belgium, Germany, Italy) as well as discussions with farmers in Sicily in March 2019. An estimate of the size of the market in Sicily is also provided.

II.2. Legal background

Pure hemp seed oil produced by simple pressing of seeds is not considered a novel food (AFSCA, Belgium¹⁶) and is therefore authorized in the food market under the regulation, provided that THC content is below 0.2% (0.3% from 2021, already implemented in some EU countries).

II.3. Nutritional quality of hemp oil

Nutritional values in hemp oil

Hemp oil contains about 10% of saturated fatty acids, about 15 % of mono-unsaturated fatty acids, about 75% of poly-unsaturated fatty acids of which about 60% of omega-6 (linoleic acid) and 20% of omega-3 (linolenic acid and others) (Wikipedia¹⁷). Thus, hemp oil offers a greatly balanced content of omega-3 and omega-6 (ratio 1/3)¹⁸. This composition is very close to nut oil (Table 9).

¹⁶ www.afsca.be/consommateurs/viepratique/autres/basecannabischanvre/_documents/2018-11-16_FAQ-Cannabis_FR.pdf

¹⁷ fr.wikipedia.org/wiki/Huile_de_chanvre

¹⁸ According to the French Food Safety Agency (AFSSA), the perfect ratio between omega 3 and omega 6 is 1: 3 (it is necessary to consume 1 dose of omega 3 fatty acids every 3 doses of omega 6 fatty acids).

Table 9: Fatty acids composition of hemp oil and other w3 rich oils.

Source: *Caractéristiques des huiles de lin et de chanvre (Morin 2015)*.

Acides gras	Formule simplifiée	Quantité en % des acides gras totaux					
		Lin	Cameline	Chanvre	Noix	Colza	Soja
Acides gras saturés	AGS	6–10	9–13	9–12	7–11	6–8	11–21
palmitique	C16:0	4–6	5–8	6–7	6–8	4–5	8–13
stéarique	C18:0	2–4	2–3	2–3	1–3	1–2	3–6
arachidique	C20:0	<0,5	<2	0,7–0,9	<0,3	<1	<1
béhénique	C22:0	–	<1	0,3	<0,2	<0,5	<0,7
Acides gras monoinsaturés	AGMI	11–23	24–48	12–17	14–21	57–65	17–27
palmitoléique	C16:1	<0,5	<0,3	<0,2	<0,2	<0,6	<0,2
oléique	C18:1	10–22	14–19	12–16	14–21	55–62	17–26
eicosénoïque	C20:1	<0,6	12–17	0,3–0,4	<0,3	1–2	<0,4
érucique	C22:1	–	1,5–4	<0,1	–	<0,5	<0,2
Acides gras polyinsaturés	AGPI	70–80	44–66	71–80	63–80	26–32	54–72
linoléique	C18:2 ω 6	12–18	18–21	55–57	54–65	18–22	50–62
alpha-linolénique	C18:3 ω 3	54–71	27–35	14–18	9–15	8–10	4–10
gamma-linolénique	C18:3 ω 6	–	–	2–4	–	–	–
stéaridonique	C18:4 ω 3	–	–	0,5–1	–	–	–

EU regulations regarding claims

There are two types of claims: health and nutrition claims. The rules of the EU Regulation apply to nutrition claims (such as "low fat", "high fiber") and to health claims (such as "Vitamin D is needed for the normal growth and development of bone in children").

A health claim is "any statement about a relationship between food and health" (European Commission definition¹⁹). The Commission authorizes different health claims provided they are based on scientific evidence and can be easily understood by consumers. The European Food Safety Authority (EFSA) is responsible for evaluating the scientific evidence supporting health claims. There are three types of Health Claims: Function Health Claims²⁰, Risk Reduction Claims²¹ and health claims referring to children's development²². **There are no health claims related to hemp-based products yet.**

'Nutrition claim' are "any claim which states, suggests or implies that a food has particular beneficial nutritional properties due either to the energy (calorific value) it provides/provides at a reduced or increased rate/or does not provide; or to the nutrients or other substances it contains/contains in reduced or increased proportions/or does not contain" (European Commission definition²³). Nutrition claims are only permitted if they are listed in the Annex of [Regulation \(EC\) No 1924/2006](#), lastly amended by [Regulation \(EU\) No 1047/2012](#). Examples of permitted nutrition claims related to fatty acids are provided in Figure 9: Examples of permitted nutrition claims.

¹⁹ https://ec.europa.eu/food/safety/labelling_nutrition/claims/health_claims_en

²⁰ Relating to the growth, development and functions of the body; referring to psychological and behavioral functions; or on slimming or weight-control.

²¹ on reducing a risk factor in the development of a disease. For example: "Plant stanol esters have been shown to reduce blood cholesterol. Blood cholesterol is a risk factor in the development of coronary heart disease"

²² For example: "Vitamin D is needed for the normal growth and development of bone in children".

²³ https://ec.europa.eu/food/safety/labelling_nutrition/claims/health_claims_en

NATURALLY/NATURAL

Where a food naturally meets the condition(s) laid down in this Annex for the use of a nutritional claim, the term 'naturally/natural' may be used as a prefix to the claim.

SOURCE OF OMEGA-3 FATTY ACIDS

A claim that a food is a source of omega-3 fatty acids, and any claim likely to have the same meaning for the consumer, may only be made where the product contains at least 0,3 g alpha-linolenic acid per 100g and per 100kcal, or at least 40mg of the sum of eicosapentaenoic acid and docosahexaenoic acid per 100g and per 100kcal.

HIGH OMEGA-3 FATTY ACIDS

A claim that a food is high in omega-3 fatty acids, and any claim likely to have the same meaning for the consumer, may only be made where the product contains at least 0,6 g alpha-linolenic acid per 100 g and per 100 kcal, or at least 80 mg of the sum of eicosapentaenoic acid and docosahexaenoic acid per 100 g and per 100 kcal.

HIGH MONOUNSATURATED FAT

A claim that a food is high in monounsaturated fat, and any claim likely to have the same meaning for the consumer, may only be made where at least 45% of the fatty acids present in the product derive from monounsaturated fat under the condition that monounsaturated fat provides more than 20% of energy of the product.

HIGH POLYUNSATURATED FAT

A claim that a food is high in polyunsaturated fat, and any claim likely to have the same meaning for the consumer, may only be made where at least 45% of the fatty acids present in the product derive from polyunsaturated fat under the condition that polyunsaturated fat provides more than 20% of energy of the product.

HIGH UNSATURATED FAT

A claim that a food is high in unsaturated fat, and any claim likely to have the same meaning for the consumer may only be made where at least 70% of the fatty acids present in the product derive from unsaturated fat under the condition that unsaturated fat provides more than 20% of energy of the product.

Figure 9: Examples of permitted nutrition claims

Source: EU Commission: ec.europa.eu/food/safety/labelling_nutrition/claims/health_claims_en.

Possibilities of nutrition claims on hemp oil

Hemp oil nutritional profile allows to use a variety of **nutrition claims** related to its fatty acids content. Hemp oil can be described as 'having a high content of omega-3 fatty acids' and being 'high in polyunsaturated fat' (Table 10).

Table 10: Examples of authorized nutrition claims on hemp oil

	Regulation limit	Hemp oil nutritional value *	Claim validity
HIGH CONTENT OF OMEGA-3 FATTY ACIDS	at least 0,6g of alpha-linolenic acid per 100g of product	14-18%	OK
HIGH POLYUNSATURATED FAT	45% of the fatty acids present in the product derive from polyunsaturated fat.	71-80%	OK

* Nutritional values from (Morin 2015).

II.4. Estimating the size of the market for hemp oil in Sicily and related production surfaces

Approximating the number of potential consumers

The intention hereby is **to approximate the number of potential consumers of hemp-based food products in Sicily**. No survey on this topic is available in literature. We therefore propose a preliminary estimate. What is the profile of a consumer of organic hemp-based food products? We suppose they are mainly local people and visiting tourists with the following characteristics:

1. local people who

- are aged 30-65: 49% of the Italian population in Sicily²⁴;
- have an interest into high-quality organic foods²⁵: we consider 2% to be a conservative figure that is consistent with the facts that:
 - 7 to 10% of Italian people follow vegetarian diets²⁶ and in this context are likely to show interest into high-quality vegetal products;
 - the market share of organic products in retail in Italy is 3,2%²⁷. Taking into consideration that prices of organic products are generally higher than conventional products (on average 30% higher²⁸). The share of organic products consumed can therefore be estimated at 2,5%.

2. tourists who

- aged 30-65: we use Sicily's ratio as a proxy - that is 49%;
- who have an interest into high-quality organic foods in the context of their holidays: we consider 2% to be a conservative figure (similar to the local consumers' ratio).

On that basis, the number of **potential consumers** of hemp-based food products in Sicily can be estimated at 193,636 people. With an average consumption of 0,2L of oil/person/year and average price of 50 €/L²⁹, this represents a potential market volume of 38 thousand liters each

²⁴ Source: ISTAT, 2018: The total population in Italy in 2018 was 60,5 million people, of which 50% of 30-65. The population in Sicily was 5,0 millions people of which 49% aged 30-65.

²⁵ This is a conservative approach. The fact that internationally Hemp-based Foods are mainly distributed in supermarkets (see Preamble) suggests that products may get out of niche markets and be commercialized more largely.

²⁶ Wikipedia

²⁷ that is 1,3 billion euros (Source: Willer, Helga and Julia Lernoud (Eds.) (2019): *The World of Organic Agriculture. Statistics and Emerging Trends 2019*. Research Institute of Organic Agriculture (FiBL), Frick, and IFOAM – Organics International, Bonn. See also *Agence BIO d'après différentes sources européennes: Les carnets de l'Agence BIO Edition 2016*)

²⁸ A recent review of the price difference that consumers are willing to pay for organic products is +30% (Aschemann-Witzel and Zielke 2015). For local products, the willingness to pay is higher, and sometimes much higher (Roosen, Köttl, and Hasselbach 2012).

²⁹ This is an average figure, local prices may be higher - but rarely lower than this.

year - that is more than five times the current production³⁰ - and a market value of 1.9 million euros (Table 11). With a similar approach, the potential market in Italy (only national consumers) can be estimated at 145 thousand liters, 6.1 million euros.

Table 11 : Approximate estimate of the potential number of consumers and hemp oil volume in Sicily and Italy

	Sicily	Italy
Number of inhabitants (millions) ¹	5,0	60,6
Number of visitant tourists (millions) ²	14,7	
Share of 30-65 ³	49%	50%
Share of hemp-based food products consumers	2%	2%
Estimated number of consumers (number)	193.636	606.434
Estimated average consumption of oil per capita (L/person/year)	0,20	0,20
Total consumption of oil (L/year)	38.727	121.287

Sources: ¹ Google; ² Le Routard.com; ³ ISTAT: see Table 17 in appendix.

Note: this table provides a rough market estimated and is intended at fostering discussion among the hemp producers rather than providing precise previsions.

III. Possible industrial development pathways of hemp oil in Sicily

III.1. Objectives and methodology

The objectives are:

- to provide learnings from case studies of hemp development from abroad (France, Belgium);
- to envision production and processing of hemp to make oil in the coming years and discuss industrial development relevance accordingly.

The analysis is based on interviews and case studies analysis (see in appendix) and literature.

³⁰ estimated at 8.000 liters - cf supra (Table 3).

From the current situation to covering the market at the Sicilian level

	Current situation	300	Market covering
Surface (ha)	100	300	600
Quantity of seeds (kg)	40.000	120.000	240.000
Production of oil (L)	8.000	24.000	48.000
Consumption (L/person/year)	0,20	0,20	0,20
Number of consumers provided with oil	40.000	120.000	240.000

III.2. Costs and profitability

Profitability

From 1 ha of hemp, 80 liters of oil and 320 kg of flour can be obtained. On basis of a price of 50 €/L for the oil and 15 €/L for the flour (conservative direct selling prices), revenues can be estimated at 9,600 €/ha (Table 12) while with prices of 35 €/L for the oil and 7 €/L for the flour (wholesale price), revenues can be estimated at 7,750 €/ha.

There are little references on the cost structure of hemp cultivation. According to the article *Canapa per uso alimentare, una soluzione che rende* (A. Frascarelli, C. Meloni)³¹, costs represents 60% of the revenues that the products provide, while margin represents 40% of the revenues. On basis of this ratio, costs can be estimated at 5,760 €/ha while margin can be estimated at 3,840 €/ha in the context of direct selling; while in the context of wholesale marketing, the margin would fall at 3,100€/ha. In both cases, the estimated margin obtained is high, and a more consistent data collection and analysis on costs and benefits of hemp cultivation would be useful to get a more reliable estimate. For further modelling (see Table 13 below), we apply a ratio of 50% to get to a more conservative assumption of the margin (respectively 1,950 €/ha in the context of direct selling and 1,550 €/ha in the context of wholesale marketing).

Table 12: estimation of oil and flour revenues, from 1 ha of hemp, based on local prices according to operators' estimates

	Volume from 1 ha (kg)	Direct selling price ³ (€/L or €/kg)	Revenues from 1 ha (€)	Wholesale price ⁴ (€/L or €/kg)	Revenues from 1 ha (€)
Oil	80	60	4.800	35	2.800
Flour	320	15	4.800	7	4.950
Total			9.600		7.750

III.3. Processing machinery

We hereby focus on pressing hemp seeds for making edible oil. We consider than grinding into flour is not the limiting factor given that there is large processing capacity already available in Sicily (at *Molino Crisafulli*).

³¹ who have modelled the cost and profits of 1ha of hemp processed in oil and flour.

Pressing machines

A pressing machine currently used in Sicily allows processing 200 kg/day while it costed 4.000€. A basic benchmark of press machines from Alibaba.com tends to show that prices for small machines (approximate capacity of 1 ton/day) range from 1,000 to 2,000 euros while prices for intermediary machines (capacity of 10 tons/day) range from 40,000 to 65,000 euros (Table 13). Pressing is a delicate processing and operators interviewed underline that machines should be chosen according to the quality level they allow to obtain. Especially, the quality results of larger machines should be carefully checked. The acreage of hemp corresponding to the seeds production that can be transformed with those machines within a period of 1 month (20 days) is estimated in Table 13.

Table 13: Examples of hemp oil press machines with their price and processing capacity ^e

Ref		Current ^d	Alibaba 2	Alibaba 3
Capacity	kg/day	200	10.000	10.000
Capacity over 20 days	kg/month	4.000	200.000	200.000
Acreage of hemp that can be transformed in 1 month ^a	ha	10	500	500
Machine indicative ^b price	Euros	4.000	40.000	65.000
Surface needed for covering the machine cost with benefits ^c	ha	3 ha	26 ha	42 ha

Notes: ^a with an average yield of 400 kg of seeds/ha - see supra; ^b generally provided as a range and has to be checked with retailer/provider; ^c calculated on basis of a margin of 1,950 €/ha (see above); ^d example of a pressing machine used in Sicily currently. The capacity of the machine suggests that to process seeds from 100 ha, the machine is used 10 months/year; ^e the quality of oil obtained is also a major criteria for the choice of the machines and is not discussed here.

References: [Alibaba 2](#); [Alibaba 3](#).

Investment capacity and profitability

Given the high margin per ha that can be obtained with oil and flour, pressing machines costs is relatively easy to cover (3 ha for covering the price of the current press machine, 26 ha for covering the price of A2, 42 ha for covering the price of A3) (Table 13).

III.4. industrial development pathways

Multiple industrial pathways exist for the development of hemp processing into oil/flour in Sicily. Four pathways were identified along the study, with diverse acreage growth and investment strategies.

Acreage evolution scenarios over 10 years

Based on above discussions, one can imagine different scenarios for acreage development in Sicily. The most conservative scenario would be a stabilization of the surface dedicated to hemp-based food products (100 ha) (*Scenario Stab*). For this discussion, we set the most ambitious scenario at reaching 1,000 ha by 2030 (*Scenario Large*). We design two intermediary scenario (*Scenario Low* and *Medium*) that could reach respectively 300 ha and 600 ha by 2030. Even in the most ambitious scenario, 1,000 ha is still a very small surface at the regional level (<0,1% of the Sicilian agricultural area).

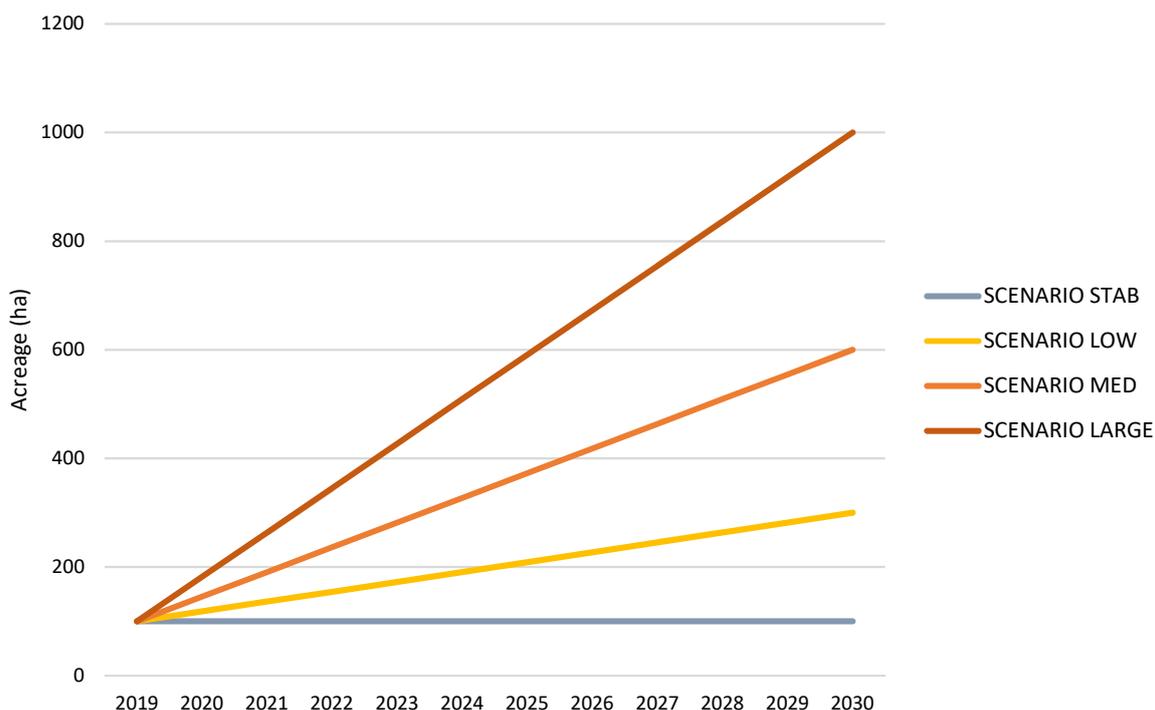


Figure 10: Scenarios of hemp acreage development in Sicily

Number of farmers participating in the scenario

Scenarios are likely to have different levels of social impact, value repartition, organizational design and governance challenges depending on the number of farmers contributing to the production. Currently, the two farms participating in the case study cultivate about 5 ha each and support other farmers in hemp cultivation on a total surface of about 100 ha of hemp for food products. We provide below a modelling of the number of farmers contributing to production depending on the acreage dedicated to hemp at farm level and overall in the region (Table 14). In the context of having many farms cultivating 5 ha of hemp, the number of farmers in the sector will range from 20 farmers to 200 farmers. with 1 ha of hemp per farm, the number of farmers in the sector would range 100 to 1.000 farmers. In this context, it can be questioned if the most innovative farms will operate as hubs for the others.

Table 14: Number of farmers contributing to hemp production depending on the acreage dedicated to hemp at farm level and the target surface at the regional level.

	Current situation	Scenario S-Low	Scenario S-Med	Scenario S-Large
Target surface in the region (ha)	100	300	600	1.000
Average acreage of hemp per farmer				
1 ha/farmer	100	300	600	1.000
2 ha/farmer	50	150	300	500
5 ha/farmer	20	60	120	200
10 ha/farmer	10	30	60	100
25 ha/farmer		12	24	40

Note: the modelling focuses on small acreage of hemp per farm, given the aleatory legal situation that maintains a high level of risk to this crop.

Industrial pathways: risks and advantages

Four pathways defined by the target acreage of hemp dedicated to food products and the machines acquisition are discussed below. Pathway I1 is related to the scenario *Stab* (acreage = 100 ha) and implies only one (optionally two) small processing capacity(ies) in the region. Pathway I2 illustrates a larger target acreage, processed through one large processing capacity. Pathway I3 illustrates an alternative choice of having several small processing capacities. Finally, pathway I4 illustrates the option of externalizing the processing.

Table 15: Some industrial pathways' risks and advantages (preliminary)

	Description	Advantages, strengths	Risks, threats, challenges	Context factors	Governance
Pathway I1	Acreage = 100 ha + 1 small processing capacity	Single stream, single point of contact	reliability of the unique processing capacity and its owner	given the estimated market size, acreage could most likely be increased above 100 ha.	Centralized entity for processing, and the different farmers could which to set up a representation entity.
Pathway I2	Acreage over 100 ha + 1 large processing capacity	Single stream, single point of contact	reliability of the unique processing capacity and its owner	Location of the machine/transport cost and accessibility (especially if a large number of providing farmers)	Different options exist regarding ownership: owned/co-owned. Works as a service provider (processor) or as an integrator (food company)?
Pathway I3	Acreage over 100 ha + several small processing capacities	proximity with markets (lower transportation costs) Value repartition	complexity risk of competition regarding prices and clients	Likely to happen if no consistent shared strategy is defined at the regional level.	independent actors --> probably relevant to create a common association for representation purposes and coordination
Pathway I4	Acreage over 100 ha + external foreign processor.	Simplicity No additional workload	Not so local Dependency on processors prices	Highly dependent on the price of transportation Location of processors?	market rules mainly

Remaining questions

Along the study, many questions were identified, and still have to be investigated, such as:

- whether processing activities are undertaken within the farm(s) context or whether should be considered as a separate legal entity;
- how feasible is the development of a processing activity in addition to already existing workload at the farms level?
- What is the proper investment rhythm (more progressive or fast);
- Processing units work as a service provider (processor) or as an integrator (food company)?
- Is there also a scenario in which the Sicilian production of hemp oil and flour would grow very rapidly and overpass the local potential demand? In that case, which national and EU markets to target?

III.5. SWOT Analysis

Table 16: a SWOT analysis of hemp-based food products in Sicily

Strengths	Weaknesses
<p>Relevant for crop diversification in wheat based systems Relatively simple products already developed and tested Nutritional quality (proteins content, quality fats) Origin EU/Italy/Sicily Potential capacity for quality differentiation vs. imported products?</p>	<p>Still some confusion in consumers' mindset (drug vs. food) --> requires a certain investment in communication Still limited local processing capacity (but local actors are interested in investing). Coordination and strategic orientation of the sector not yet structured.</p>
Opportunities	Threats
<p>Italian food culture includes pasta and oil consumption, making the potential market very large (although specific pasta and oil still represents a change in habits). Tourism = interest for local, high quality products</p>	<p>Countries with large production are very competitive (eastern Europe, Canada, China) Risk of competition vs coordination in the territory Growth of the acreage may lead to increased pest pressure³².</p>

Conclusion

This study focused on the potential of value chains for hemp oil and flour in Sicily. Hemp cultivation in Sicily was reintroduced recently and is relatively small but is very relevant in farming systems (both economically and environmentally). Hemp oil and flour are quality, local products with a great potential of valorization and the potential market for hemp-based food products in Sicily is not yet addressed. For further years, operators that produce and process hemp have the possibility of adopting diverse pathways.

³² According to (O'Brien and Arathi 2019), as cultivation of hemp continues to expand, insect pests on hemp could become prevalent. Their results documenting bee diversity in hemp provides the impetus for the development of integrated pest management plans that protect pollinators while controlling pests.

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Appendix

Data on processing capacity in Sicily



Figure 11: Location of hemp processing capacities in Sicily

Notes:

- The identification of processing capacities was done by local operators. Other realities might be present but there is no public information in this topic.
- the Cooperativa Colli Erei declared in 2019 they would also start an oil extraction activity.

Population in Italy

Table 17: population in Italy and Sicily

	Total population	Population aged 30-65	
Italy	60.483.973	30.321.705	50%
Sicily	5.026.989	2.467.194	49%

Source: ISTAT, 2018.

Data extraction: 20th of May 2019.

List of projects identified

- **L'Chanvre** (France) (website: www.lchanvre.com).
 - Farmer-founded small company created in 2002. Growth from 2 to 9 persons.
 - Production, processing and commercialization of hemp-based food products.
 - Specific machinery ensuring high oil quality.
 - contact@lchanvre.com

- **PurChanvre** (Belgium) (website: www.purchanvre.be).
 - Farmer-founded small company created 2011 by three people.
 - Production & processing of hemp-based food products.
 - NB: Purchanvre, dedicated to hemp-based food products, is still running while **Belchanvre**, a cooperative of hemp producers founded in 2015 (about 30 farmers) aiming at producing industrial hemp especially for construction purposes, was dissolved early 2019 as the local 2-million euros processing factory called Be.hemp failed.
 - info@purchanvre.be

- **Ananda** (www.anandaetcie.org) (France)
 - Small company dedicated to the processing and commercialization of hemp-based food products.
 - Machinery: a press, a stone grinder, a roaster and a flour sifter.
 - info@anandaetcie.org

- **ASBL Chanvre wallon** (Belgium) (website: www.chanvrewallon.be)
 - An association of producers and processing actors.
 - Its missions are: supporting the development of hemp cultivation in the region, federating the actors of the sector, developing commercial opportunities for the various hemp products, and to widely promote hemp and hemp products to different target audiences.
 - info@chanvrewallon.be.

Synthesis of an interview of a producer in Belgium (in French): Robert Masson (PurChanvre)

Introduction

Robert Masson est agriculteur en Hesbaye. Il gère une exploitation de 36 ha et travaille en parallèle dans une entreprise agricole.

Culture du chanvre

En 2010, il a planté 1,5 ha de Chanvre à titre expérimental. Dès 2011, il achète une presse et un filtre pour transformer les graines produites en huile. La culture et la transformation sont prometteuses. Il identifie aussi un transformateur de lin qui voulait se diversifier et qui s'annonce intéressé d'acheter les fibres de chanvre.

Il cherche alors à développer la culture. Il convie d'autres agriculteurs à produire du chanvre et à créer collectivement une filière pour cette nouvelle production. Ils seront finalement une trentaine à créer une coopérative : BELCHANVRE.

Ils sèment dès lors 80 hectares et vendent à des acheteurs en Hollande et en France. Mais ils se rendent compte que c'est peu rentable : le prix est peu élevé et le transport cher, ils ne font au final pas de bénéfice.

Ils décident alors de mettre en place une capacité de transformation locale. Soixante membres se réunissent pour monter une industrie de séparation de la paille en fibre, l'objectif étant de se tourner vers le marché du textile et des produits techniques. L'investissement nécessaire

s'élève à 2 millions d'euros, dont 3/4 prêté par des banques et 1/4 de la somme amenée pour partie par la coopérative d'agriculteurs et des acteurs du commerce (par ex. Delhaize, IGB...). Ils créent une société pour gérer l'investissement: Be Hemp.

En 2016, ils construisent l'usine : 2 ha, 2 bâtiments. Mais le capital nécessaire pour une ligne de production haut de gamme s'élève à 2 millions d'euros ; ils optent pour une ligne plus simple proposée par un petit fabricant de machines flamand. Malheureusement, la ligne s'avère défectueuse et ne rentrera jamais en activité. Le conseil d'administration de la société, composé de sept membres, ne parvient pas à ajuster son choix de prestataire et sa stratégie. La société et la coopérative seront déclarées en faillite.

D'autres modèles : le matériel de récolte

Il crée aussi la société CMH, possédant une machine de récolte de la paille de chanvre pour avoir des brins de la longueur souhaitée et qui permet même de ramasser s'il y a eu de la verse. Ils déposent un brevet là-dessus.

La production à petite échelle : Pur Chanvre

A son échelle, il continue à produire de l'huile, de la farine.

Alors qu'initialement, il fait la transformation à la ferme, des exigences croissantes de normes sanitaires (rappelées lors de contrôles AFSCA récurrents) et de réglementations spécifiques au chanvre (dérogation nécessaire avec échantillonnage et mesure des taux de THC) le poussent à transformer sa production ailleurs, au Grand Duché du Luxembourg et en Autriche pour d'une part le pressage/embouteillage et d'autre part la préparation de huit produits: graines au piment, graines salées, sucrées, graines enrobées au chocolat.

Depuis décembre, en effet, une norme spéciale sur le contenu en THC³³ de l'huile de chanvre est en effet à l'œuvre en Belgique qui l'oblige à passer par d'autres pays : alors que la norme générale dans l'UE est de 0,2% de THC, elle est de 0,3% dans certains pays (Autriche, Luxembourg) et spécifiquement très basse en Belgique: 1 micro gramme pour 100g, soit 0,001% THC.

Des analyses qu'il a menées sur des produits sur le marché montrent qu'il y a énormément de fausses huiles de chanvre, avec des teneurs en CBD très différentes des étiquettes (en général, teneur réelle bien inférieure à la teneur affichée).

Le mode de production

Il fait une rotation sur quatre à cinq ans : pommes de terre, chicons, blé, colza, petit pois, chanvre...

Selon lui, certains producteurs en agriculture biologique en Autriche parviennent à faire de la monoculture (chanvre sur chanvre), en apportant les éléments minéraux nécessaires, mais commencent à avoir des champignons qui se développent car les sols sont trop enrichis.

Il ne travaille pas sans intrants : 100 unités d'azote, 150 unités de potasse, qui peuvent être apportés par des lisiers de porc, du fumier de poule. Il est important de bien nourrir le sol car la plante est très demandeuse. Selon lui, les articles qui signalent le chanvre comme une plante pouvant être cultivée "sans intrants" sont mensongers.

La transformation

³³ (pas de norme sur le CBD).

Il souligne la vigilance à avoir sur taux résiduel d'humidité dans la farine, qui fait qu'elle risque de se dégrader très rapidement (7% serait une valeur limite).

La production de chanvre en Europe

Selon lui, il y a de très grandes capacités de production (surfaces, main d'œuvre) en Europe de l'Est, notamment en Roumanie, Hongrie, Ukraine... Les rendements y seraient très élevés, de l'ordre de 2t/ha (grâce à la luminosité, et au haut potentiel agronomique des terres).

La valorisation

Le marché est en croissance, mais la production grandit également, conduisant à une diminution des prix : auparavant, la graine (issue de l'agriculture conventionnel, 99% pure) se vendait entre 1,700 et 2,500 €, aujourd'hui à 400 €/t. Les volumes de vente ont également augmenté. Selon lui, en 2016, on vendait par lot de 120 à 130 tonnes, aujourd'hui on propose par 500 à 800 tonnes.

Pour lui, aujourd'hui, la compétition au niveau européen et mondial est telle qu'il y a seulement potentiel pour une valorisation locale. Il parle d'huile de chanvre dans les supermarchés en Belgique (Delhaize ou Colryut) importée de Chine et en vente à un prix de 8€ les 25 cL (soit 32€/L).