FIBRA PROJECT

Fibre Crops as Biobased Material source for Industrial Products in Europe and China


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The FIBRA network has as main target to link the research activities carried out on both EU and China and to provide a long term vision on future common research activities on fibre crops and will improve researchers’ training opportunities.

The expected impact of FIBRA project is the establishment of an effective and wide co-ordination of the research activities on fibre crops in Europe and China thus to stimulate a broad stakeholders’ participation and generate common research programmes to fulfil the international EU policy targets.
Some details about the FIBRA project

- FIBRA project is a **coordination and support action project** funding under the 7th Framework Programme.
- FIBRA started in **September 2012** and will finish at the end of **November 2015** (39 months).
- A total number of **16 partners** participate in the project (15 from Europe and 1 from China).
- The partners will receive a total finding of **999915 euros**.
- A **Chinese Mirror Group** have been established to support the FIBRA project.
- The **Chinese Mirror Group** is receiving additional funding from the Chinese Academy for Agricultural Sciences (CAAS).
- The project website is [www.fibrafp7.net](http://www.fibrafp7.net)
FIBRA concept

WP1. Fibre Crops Optimisation for multiple uses
WP2. Biorefinery product chain

FIBRA Research activities link between EU and China

WP3. Broad networking
WP4. Large set twinnings
WP5. Training opportunities

WP6. Long term vision

WP8. Dissemination
According to [www.fibrecrops.nl](http://www.fibrecrops.nl) a botanic classification can be made for fibres based on the part of the plant from which they can be obtained.

The major groups of fibre crops with technical or economic importance are: **bast fibres, grass fibres, leaf fibres, seed hairs, palm fibres and woody fibre**.

In **FIBRA** we focus on **fibre crops with common interest in EU and China**, which are:

- **Bast fibres** (flax, hemp, kenaf, jute, nettle, and ramie),
- **Grass fibres** (miscanthus, switchgrass, giant reed and bamboo),
Bast fibres
(flax, hemp, kenaf, jute, nettle, and ramie)
Grass fibres
(miscanthus, bamboo, and reed)
The **bast fibre crops** are considered the most important group worldwide, after cotton.

**Flax** and **hemp** are the most important for Europe, while in China **jute ramie** and **kenaf**, are also major crops supported by a significant research activity in breeding and cultivation.

### World fibre production, cultivation area and yield (FAO, 2009).

<table>
<thead>
<tr>
<th>Crops</th>
<th>Production (Mt)</th>
<th>Cultivated area (Mha)</th>
<th>Yield (t/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flax</td>
<td>458</td>
<td>322</td>
<td>1.4</td>
</tr>
<tr>
<td>Hemp</td>
<td>70</td>
<td>49</td>
<td>1.4</td>
</tr>
<tr>
<td>Jute</td>
<td>2952</td>
<td>1264</td>
<td>2.3</td>
</tr>
<tr>
<td>Ramie</td>
<td>253</td>
<td>125</td>
<td>2.0</td>
</tr>
<tr>
<td>Other bast fibres</td>
<td>299</td>
<td>215</td>
<td>1.4</td>
</tr>
</tbody>
</table>
Over the last 20 years, the total planting area of combined kenaf/jute in China ranks the third in the world.

In China the mean cultivated area was 150,000 to 400,000 ha with a over 900,000 ha in 1985.
The larger area of fibre flax is in Belarus with 63000 ha, while quite big is also in Russia (55000 ha), in France (67760 ha) and in China (50000 ha).
The larger area of linseed cultivation is in Russia, while in China, India and Canada the area of linseed cultivation is quite big.

<table>
<thead>
<tr>
<th>Country</th>
<th>Area (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Russia</td>
<td>472,000</td>
</tr>
<tr>
<td>China</td>
<td>350,000</td>
</tr>
<tr>
<td>India</td>
<td>338,810</td>
</tr>
<tr>
<td>Canada</td>
<td>273,200</td>
</tr>
<tr>
<td>Kazakhstan</td>
<td>90,000</td>
</tr>
<tr>
<td>France</td>
<td>77,292</td>
</tr>
<tr>
<td>Ukraine</td>
<td>58,700</td>
</tr>
<tr>
<td>Belarus</td>
<td>49,981</td>
</tr>
<tr>
<td>UK</td>
<td>36,000</td>
</tr>
<tr>
<td>Italy</td>
<td>3,000</td>
</tr>
<tr>
<td>France</td>
<td>2,160</td>
</tr>
</tbody>
</table>
In early 90’s a increase in the hemp cultivation area was recorded due to the

- Changes in the CAP (exceeding, no food crops,...);
- Environmental awareness;
- Sustainability of agriculture;
- Consumer perceptions.

The cultivation area of hemp in Europe (2012) is around 15,000 ha. 11,800 ha are in France that corresponds with the 0.05 % of its total agricultural area.
The total cultivation area of bast fiber crops in China is $11.51 \times 10^3$ ha.

The highest productivity per ha is being reporting by flax (6.47 t/ha) and the lowest by ramie (1.98 t/ha)
Distribution of Bast Fiber Crops in China

- Ramie
- Flax
- Kenaf/Jute
- Hemp
High yielding crops like miscanthus, giant reed, switchgrass, reed canary grass, elephant grass, bamboo, etc. are alternative and innovative fibre crops.

Whether their fibres quality is lower than that of bast fibres (i.e. fibre fineness, length and lignin content), the high productivity associated with a low energy requirement, could make them interesting feedstocks for papermaking, bio-building or biopolymers, and bioenergy purposes.

During the last two decades several grass fibres (miscanthus, giant reed, switchgrass, etc.) have been tested as raw material for solid biofuels, while recently are being tested as raw material for biobased materials as well as for second generation biofuels.
• **Miscanthus** is one of the main raw materials used in the **Republic of China** for paper making, and in several studies undertaking miscanthus for paper pulp production.

• In **Europe** miscanthus is being cultivated in a total area of **3000 ha** (Germany, Poland, Austria and UK) as raw material for **solid biofuels**, while it is considered a valuable alternative to wood fibre both for bio-building and paper pulp purposes in Europe as well as for **second generation biofuels**. Currently, it is investigated in three European projects namely **OPTIMA, OPTIMISC** and **GRASS MARGINS** that started in October 2011 and will finish in the beginning of 2016.
• The added value is the highest at the top of the pyramid and the lowest at the bottom. On the contrary, the volume of biomass needed for the applications is the lowest at the top of the pyramid and the highest at the bottom of the pyramid (www.bio-basedeconomy.nl).
The main platforms, process, products and markets in a biorefinery concept of bast fibre crops.
The issues that addressed in FIBRA are:
- *State-of-the-art for the Main products and the Secondary products*
- *Anticipated development in short term*
- *Anticipated development in long term*
Markets of the fibre crops

- Textiles
- Non-woven
- Wood, Timber
- Pulp, paper and board
- Cellulose dissolving pulp
- Cellulosic firms
- Building materials
- Cellulosic fibre composites
- Lignocellulosic biorefinery and green chemicals
Hemp products
(modified from Small and Marcus, 2002)

- Food (Polysaccharides, Fatty acids, Amino acids, Secondary metabolites)
- Paper (Polysaccharides)
- Textiles (Polysaccharides)
- Medicines (Secondary metabolites)
- Essential oils (Fatty acids, Secondary metabolites)
- Nutritional supplements (Fatty acids, Amino acids, Secondary metabolites)
- Bedding (Polysaccharides)
- Feed (Polysaccharides, Fatty acids, Amino acids, Secondary metabolites)
- Plastics (Polysaccharides, Amino acids)
- Body care (Fatty acids, Secondary metabolites)
- Bioenergy and construction (Polysaccharides)
Flax products
(source: Prof. Jan Szopa, University of Wroclaw)
Kenaf products

- Organic absorbent
- Polymer compounds
- Insulation material
- Insulation mats
- Bioplastic for

30-31/10/13
A synopsis of the state-of-the-art knowledge on socio-economic and environmental issues in relation to the production of fibre crops mainly based on literature review and for the situation in Europe and China is on-going and will be completed in month 24 (August 2014) and will be revised in month 36 (August 2015).

In the environmental assessment the use of water and mineral resources, soil quality and erosion, emission of minerals and pesticides to soil and water, waste generation and utilization, landscape, energy savings, greenhouse effects, acidification issues and biodiversity will be studied.
The project started in **September 2012** and in the first year **two workshops** and **one summer school** were organised.

The **two workshops** were:

- 20/3/13, Rome entitled **“Agronomy and logistics of fibre crops”**
- 6/6/13, Copenhagen entitled **“Can EU agriculture feed both the energy and bio-based industries of the future in a sustainable way?”**

The **summer school** took place in Catania from 21\(^{st}\) to 27\(^{th}\) of July 2013. The summer school was organised by University of Catania and CRES.

- The title of the summer school was **“FIBRE CROPS: FROM PRODUCTION TO THE END USE”**
A **twinning & matchmaking event** will take place in Wageningen (The Netherlands) on 30\(^{th}\) and 31\(^{st}\) of October 2013.

In this event *European* and *Chinese project coordinators* will participate as well as representatives from European and Chinese.

The **summer school** will take place in Lisbon from 26\(^{th}\) to 31\(^{st}\) of July 2014. The summer school was organised by University of Lisbon and CRES. The summer school will concentrate on *bast fibre and grass fibres as ideal crops for future biorefineries*. 
The technical information that will be collected from the project partners regarding genetics, agronomy, logistics, products, markets, environmental issues and social implications as well as

The information that will be collected from the project events namely workshops, summer school, twinning & matchmaking events as well as from the FIBRA conference will contribute on the creation of the

“Long Term VISION on FIBRE CROPS in both EUROPE and CHINA”
Long term vision of FIBRA

WP3, WP4, WP5
Wide range dissemination events (workshops, twinning events, etc.) will provide additional information

WP1, WP2
Research projects (European and chinese) and literature will provide information on the whole production chain of fibre crops

The Advisory Board of FIBRA and the Chinese Mirror Group

FIBRA results:
Top-down analysis
Bottom-up analysis

Long term vision
The consortium

Fibre Crops as a sustainable source of biobased material for industrial products in Europe and China

FIBRA consortium

European Advisory Board

Chinese Mirror Group
IBFC: Institute of Bast Fibre Crops in China, YU: HIC - Institute of Industrial Crops, Heilongjiang Academy of Agricultural Sciences, YAAS - Yunnan Academy of Agricultural Sciences Institute of Industrial Crops

Chinese Advisory Board
HAU - Huazhong Agricultural University, HU - Hunan University, FAFU - Fujian Agriculture and Forestry University, HH - Hunan Huasheng company and director of Hunan Huasheng Lt
Thank you very much for your attention

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www.fibrafp7.net