



Bologna, 17 September 2008

First Workshop of the 4F CROPS Project
“Future Crops for Food, Feed, Fiber and Fuel”
www.4fcrops.eu

Market needs of non-food crops (fibre and fuel crops) and how they can fit the available agricultural land in EU27

The first workshop of 4FCROPS (organized by University of Bologna - UNIBO and the project coordinator - CRES) carried out in Bologna (17/9/08) as a optional side event of the 10th Congress of the European Society of Agronomy - ESA Congress (www.avenuemedia.eu/source/congressi/congressi_2008/Congress_ESA) and the main objective was the market needs of the non-food crops (fibre and fuel) in EU27 and how can fit in the available agricultural land in EU27.

A total number of nine presentations were made starting with a presentation from **Dr. Piero Venturi** (EU Commission, DG Agriculture) that presenting the “Biofuels and biomaterials in FP7: a European perspective”. **Dr. Efi Alexopoulou** (CRES), as 4FCROPS coordinator, presented briefly the structure of the project. Then, **Dr. Harriette Bos** (Wageningen University) presented the market demands for non-food products in EU. **Dr. Ewa Ganko** (EC BREC) spoke about agricultural land availability for the non-food crops in EU and which are the main land use drivers. **Prof. Ryszard Kozlowski** (INF & MP) as an expert on fibre crops presented the most important fibre crops and their main applications. **Dr. Rainer Janssen** (WIP) outlined the European bioethanol situation.

A very important part of the workshop was the presentations that were made from three companies those producing biobased products. These success stories were presented: a) industrial products from the fibre crop kenaf by the Italian company KEFITALIA (**Dr. Marco Errani**), b) natural resins production by the Greek company Chimar Hellas (**Dr. Eleftheria Athanasiadou**) and pellets production using several biomass materials by the Greek Company HELLENIC PELLETS (**Mr. Nicholas Hatziannis**).

KEY WORKSHOP FACTS

Market needs of the non-food crops (fibre and fuel crops) in EU27

The concept of use the non-food crops for a large variety industrial uses is not new. Some of the most important industrial uses are: biofuels (bioethanol and biodiesel), bioplastics, building materials isolation materials, natural fibres composites, paper and fibres production, pellets for energy production, packaging materials, paints, coatings, dyes, resins, etc.

According to FAOSTAT 2005 a final selection among the possible biobased products led to a selection of 780 products that classified in three groups (A&F):

- Materials (fibres for paper, fabrics and composites, wood for timber and energy) **323 products**
- Substances (starch for plastics, glues and additives, bio-oil for paints, inks and transport fuels) **101 products**
- Chemical building blocks (lactic acid for additives and polymers , ethanol for fuel and plastics, furans for resins and fuels) **356 products**



In order to determine the present and future demands for non-food crops the following approach should be followed:

Drivers (€, GHG, health, safety...) → Market demand (materials, chemicals, energy)
→ Functionality → Commodity (starch, protein...) → Crop

It has been estimated that the biomass used for non-food products is around 8.5 Million tons (it should be higher because of the missing confidential data). In this quantity the demand of biofuels has not been included.

The present market size of biobased non-food products in EU25 had been estimated to 250 Billion €, while the present market size of food/feed products in EU-25 is 460 Billion €. The largest potential for growth is estimated that will be recorded in building blocks (240%).

Agricultural land availability in EU: land use drivers

The EU agriculture is devoted to the cultivation of food and feed crops. The main crops in EU are: cereals, corn, oilseeds crops, and sugar beet and protein crops. The main changes that were recorded in EU27 agriculture in 2008 are the followings:

- 5.7 % increase in the cereals area probably due to the high producer price (the imbalance between supply and demand for cereals worldwide led to important reduction of fallow land).
- 3.1% decreases in the rapeseed cultivated area as a result of the partial shift to cereals cultivation (a lot of debate about the competition between feed and fuel production).
- 13.5% decrease in protein crops cultivation area and this reduction the last five years is 35.5%.
- 6.8% reduction in sugar beet area as effect of the reform of sugar regime (-19.3% relative to the 2003-2007).

In EU the current area devoted to energy crops is estimated to 4 Mha. The larger part of this area is referring to crops for biofuels production (biodiesel and bioethanol), while non-food crops have been established for the solid biofuels production. The main crops that are being cultivated for solid biofuels production are: miscanthus, reed canary grass, willow and poplar (perennial crops): 9000 ha in PL, 20000 ha in SE, 10000 ha in UK and 15000 ha in FI. Special payments for perennial crops plantation establishment have been introduced by some Member States.

The main structural drivers for land use allocation:

- Steady rise in global food demand,
- The emergence of the biofuels market,
- The significant slow-down in cereal-yield growth in the EU,
- Direct payment decoupling in the EU and other CAP regulations

Other factors that should be taken consideration are the adverse climatic conditions, the nature conservation and the GMO authorisation.

Fibre crops and their applications

There are a large number of fibre crops that can be cultivated worldwide with numerous industrial applications. The most important crops are: hemp, flax, cotton, jute, kenaf, ramie, bamboo, etc.

Important facts that should be pointed out for the fibre crops applications are:



- Fast growing population as well as eco and health awareness creates large space for future expansion of other than cotton natural fibres.
- Recent achievements in breeding, production and processing extended the use of green fibres in textiles and non-textile applications.
- Due to fast progress in research and development, green fibres (bast fibre plants) are used in growing amounts for non-wood pulps.
- Some cultivation of natural lignocellulosic fibrous plants like flax and hemp can solve the problem of the extraction of heavy metals from polluted soils. Using this approach, even heavily polluted areas can be recultivated.
- Green fibres will be used in increasing amounts in a wide-spectrum of biocomposite materials. Being lignocellulosics they can be combined with man-made or natural polymers to provide a wide range of useful composites in textiles (including geotextiles and non-woven-containing ones), in particleboards and boards of other types, thermosetting resin-containing goods, filters, in transportation, building industry and agriculture. Biocomposites of the future have to be recyclable and fully biodegradable.

The main advantages of the green fibers are:

- Their **biodegradability** and the fact that when combined with polymers or natural resins they are as **strong as steel** yet of **lower density**. Such composites may be used for vehicles, building elements, furniture, machine constructions, insulating materials, gardening and agriculture equipment, tropical housing and even grape holding structures.
- In conventional lignocellulosic board composites a new bonding systems based on **enzymatic activation of lignin** will play an advanced role in the future, replacing synthetic non-ecological resins.
- **Recycling** of natural fiber-reinforced composites is relatively easy and convenient. This fact makes one of the most important factors in forecasting the future **growth of production and consumption** of these materials.

The bioethanol market situation in EU27

In 2007 the total biofuels production has been estimated to 59.4 billion litres (15.7 billion gallons), while the total bioethanol production is approximately 50 billion litres. 49% of the total bioethanol production is produced in USA (24.5 billion l), followed by 42% in Brazil (21.3 billion l), 3% in EU 1.7 billion l and in China 1.8 billion l. The top five countries in EU biomass production are France, Germany, Spain, Poland and Sweden.

The new RE Directive includes a binding target for biofuels in transport of 10% in 2020, while the previous one that set the target of 5.75% biofuels by 2010 was the one that boost the biofuels production in Europe. Many EU countries implement biofuels promotion policies (Germany, France, Spain, Sweden, etc.). A strong slowdown was recorded in 2007 regarding in bioethanol production only 13%, while in 2006 was 73% and 47% in 2007.

The main reasons for this slowdown increase are:

- Increase in the prices of cereals,
- EU refinery structure (deficit in diesel, excess in petrol) and rice
- Rise in imports of BE (Brazil, South Africa, Pakistan, Ukraine)

Recently, an increase of bioethanol imports has been recorded from Brazil to UK, Netherlands, and Scandinavia.



On-going discussion is taking place on biofuels sustainability criteria and the main criteria will be the level of GHG reductions as well as the environmental and social criteria.

The contribution of biofuels to recent increase in food prices is minor. The main reasons for price increase of agricultural raw materials were

- Adverse climatic conditions in producer countries (low stocks)
- Increased demand for food (especially meat) in emerging economies
- Increased raw oil prices
- Speculations on the raw agricultural product market
- Land use competition for biofuels production

Increasing efforts that will lead to the bioethanol production from ligno-cellulose is carried out that eventually will result in the production in second generation biofuels.

Industrial products of kenaf

Kenaf (is an annual spring fibre crop) with several industrial applications such as: paper pulp, insulation materials, yarn, horse bedding, car panels, and clipboard.

KEFITALIA (www.kenaf-fiber.com) is an Italian company situated in Guastalla (close to Bologna) that produces many products from kenaf. KEFITALIA uses the kenaf that is produced in an area of 700 ha close to its premises as well as imported kenaf fibres from Asia in order its plant operation lasts longer.

One of the most important products that KEFITALIA produces from kenaf fiber is the insulation panels under the name ISOLKENAF that the company is promoted as the natural insulation panels for not “insulating” Kyoto. ISOLKENAF are natural panels with no glues and the main characteristics are:

- Eco-sustainability and renewability
- Thermal and acoustic insulation at the same time
- Light but resistance
- Wide range of Density, Thickness, Dimension
- Selling prices matching market's
- Excellent general performances

KEFITALIA is doing a lot of research in order to produce more natural products from kenaf such as composites.

Pellets production from non-food crops

In Europe the main pellets producers are Sweden, Austria, Germany, Italy, Estonia, Latvia, Russia, Poland and Denmark. The main drivers for the pellets production are: the increasing oil prices, the increasing CO2 prices as well as the policies for heating and policies for large scale electricity production.

The main barriers that have been recorded so far are: the lack of policies for large scale use, the high investments for pellet-burning devices, the competition for feedstock, the prices and trade value statistics and the competition with natural gas and coal and the sustainability criteria.

HELLENIC PELLETS (www.hellenic-pellets.gr) is a Greek company that selling mainly wood pellets. Recently, the company included in its activities the pellets production from several material non-food crops, in the framework of a national programme in the area of north-east Greece. Hellenic pellets is trying to produce pellets from several types of wood residues, agricultural residues are available in



the area such as cotton residues as well as material from the cultivation of non-food crops (giant reed, kenaf, etc.).

Resins production from non-food crops

CHIMAR Hellas Company (www.chimarhellas.com) is a Greek company produces natural resins for the production of composite wood panels. The company is carrying out research on producing resins from several natural products or by-products, which are *tannin, lignin, cellulose, spent pulping liquor from paper production, biomass pyrolysis oil (bio-oil) and its fractions, extraction/liquefaction products of agricultural and forestry residues (cashew nut shell liquid (CNSL), liquefied wood, liquefied olive stones, vinasse), starch and proteins (soy).*

The main company objectives for the resins production are:

- Environmentally friendly adhesive resins for the wood panel industry
- Same or enhanced performance of the new resins as compared to the conventional ones
- Low cost resin products for the wood panel manufacture

