Poznan, 17 November 2009

***Third Workshop** of the 4FCROPS Project*
Future Crops for Food, Feed, Fiber and Fuel
www.4fcrops.eu

Can the production of non-food crops be environmentally friendly and economically viable?

The third workshop of 4FCROPS project (organized by INF & MP and the project coordinator-CRES) carried out in Poznan (17/11/09) in the premises of the Institute of Natural Fibers and Medicinal Plants (http://iwnirz.pl) and the main objective was to examine if the production of the non-food crops be environmentally friendly and economically viable.

A total number of eight presentations were made starting with a presentation from ***Dr. Efi Alexopoulou*** (CRES), as 4FCROPS coordinator, presented briefly the structure as well as the progress of the project. ***Mr. Nils Rettenmaier*** (IFEU) based on the work that have done in 4FCROPS presented the LCA results of the non-food crops. ***Prof. Melvyn Askew*** (CENSUS-BIO) with his presentation discussed the future challenges to sustainable production from land based industry. ***Dr. Maria Mackiewicz-Talarczy (INF & MP)*** tried to answer to the main topic of the workshop taking as an example the non-food crops cultivated in Poland. ***Dr. Luigi Pari*** (CRA) investigated how the choice of the logistic chain can influence the environmental impacts of the agro-energy system when the cultivated crop is poplar. ***Prof. Ralph Sims*** (IEA Bioenergy) made an overview presentation regarding the sustainable crop production. ***Prof. Spyros Kyritsis*** (AUA) connected the energy and agricultural production with the sustainability of the biofuels. In the last presentation the economic viability of the non-food crops was discussed by ***Prof. Peter Soldatos*** (AUA) taking as example the arable land reallocation in Greece.

KEY WORKSHOP FACTS

Life Cycle assessments of the future crops for fiber and fuel

LCA analyses carried for the 15 selected non-food crops in 4FCROPS starting with the conversion pathways (crop category, convention path, main product and use). The main conclusions of the LCA analysis were:

- All assessed biofuels and biomaterials show environmental advantages as well as disadvantages when compared to their fossil/conventional equivalents.
- Most biofuels and biomaterials show advantages with regard to energy savings, greenhouse effect and summer smog.
- In contrast, most biofuels and biomaterials show disadvantages with regard to acidification, eutrophication and ozone depletion.
- The results don‘t show clear tendencies with regard to human toxicity.
- An objective decision for or against a particular fuel or biomaterial cannot be made. However, based on a subjective value system a decision is possible.
- If, for example, energy savings and greenhouse effect is given the highest priority, all biofuels and biomaterial applications assessed are to be preferred over their fossil equivalents.
- The amount of energy and greenhouse gases that can be saved greatly differs depending on the crops, conversion paths and main products.

The produced product had a strong influence on the LCA analysis. As land-use competitions are increasing, it is necessary to allocate the limited amount of biomass to the different sectors (food, feed, fibre, fuel) in such a way which achieves the highest environmental benefits.

Future challenges to sustainable production from land based industry (economically, environmentally and social viable)

Sustainability is a function of economic viability, cost of environmental impact and social/cultural acceptability. Sustainability needs to be taken at a continental or even worldwide level in long term.

The major impacts of policy making are: CAP revision for 2013, land and water directives, the pesticides reductions that European parliament looking for. The consequents to use food crops for biofuels production (like corn in USA that highly subsidized) should be carefully examined.

It should also be considered that: a) the land use for environmental purposes may reduce crop areas for food production, b) the responses to global warming and to water management may mean land coming out of arable crop use and going into grassland or forestry to preserve soils and avoid erosion (this means less area for food production), c) an emphasis on bio/organic farming – cannot provide the world with current levels of food.

It should be emphasized that the decline of the biodiversity has cost over £50 billion sterling so far. There is great risk the 85% of rainforest could be killed off in the next 100 years if temperatures rise by 4 C degrees, while 25 to 40% of African species become extinct if temperatures rise 3 C degrees.

Some impacts of the global warming are: a) major droughts or storms, in general deficit in water supply, erratic rainfall patterns, b) Great Barrier Reef disappears – no tourism, c) 3 to 5000 extra heat-related deaths per year in Australia (but NB France in 2008/9), mass migration from S. Europe & impact on land availability in N Europe, d) declining food supply and therefore food choice. There are more problems related to the global warning such as: a) new diseases of animals, b) new & increased disease & pest spectrum for crops- but pesticides declining in EU, c) need for new approaches to plant breeding to obviate the climate change impact, d) need for reappraisal of most production techniques for plants and animals esp H2O.

Whilst global warming and water availability in particular will be key drivers affecting sustainability it must not be forgotten that policy makers are not necessarily fully linked into the system and do not necessarily understand fully the needs of land-based industry. Steps are needed to inform policy making and indeed the general public about challenges and opportunities.

Could be the non-food crops in Poland environmentally friendly and economically viable

The profitability of the cultivation of non-food crops in Poland depends on the site of the cultivation, on the selective cultivated crops and the utilization.

Rapeseed is considered the major non-food crop and its area of cultivation estimated to be 1.0 - 1.5 million ha; 50% of the harvested seeds used for human consumption, while the other 50% is being used for biodiesel production.

In Poland bioethanol can be produced by cereals, corn, potatoes, beetroot, etc. It is estimated that the total cultivation area of crops dedicated for bioethanol production will be 600,000 ha in 2020.

The selected crops for biomass production for light soils and low rainfall rate are: corn, sweet sorghum and hemp, while for heavier soils and higher rainfall rate are: willow, miscanthus and sida. Sweet sorghum gave dry matter yields 28 to 36 t/ha, corn 19 to 36 t/ha, industrial hemp 14 to 31 t/ha, willow 7 to 11t/ha, miscanthus 9-15 t/ha and sida 7-11t/ha. The energetic value of the above mentioned biomass species did not varied significantly. The insertion of hemp in agricultural practice in Poland will depend on the reform of the regulation on counter drag abuse, which will enable the use of fibrous hemp for the energy production.

The supply of the feedstock for agricultural biogas plants will depend on the involvement of agricultural advisors aiming at organization of producers groups and the service stations, equipped in the specialized machines, on providing the sale system and profitable prices for these producers those who purchase biomass (based on bilateral commercial agreements). Moreover, significant role will play the active involvement of local authority organizations, which should contribute to gaining the waste feedstock's for biogas plants, where the plant biomass should be the supplement only.

How the choice of the logistic chain can influence the environmental impacts of the agro-energy system

In Italy poplar has been selected for energy production and farmers and farmer association are investing in this opportunity and poplar grown as Short Rotation Coppice (SRC) is the main crop utilised for this purpose. How the choice of the logistic chain can influence the environmental impacts of the agro-energy system is investigated.

A research programme to evaluate the performance of different storage systems for various particle sizes of poplar was carried out in Savigliano, Italy. The aim was to study the effect of particle size, pile covering, ventilation and compaction of chip piles on fuel quality parameters during outdoor storage.

The main results of this study summarized below:

- The light, felling-windrowing machine was able to work during this rainy winter, postponing the use of the chopper and loader machine as well as trailers until April or May.
- The machine, still in experimental phase, harvested 50 ha and showed good performance with a 1.20 ha/h working capacity.
- This prototype is the first step for the development of the 2 rows felling-windrowing harvesters
- Windrows were harvested and chipped by Spapperi, Jordan and Claas Jaguar equipped with pick up between March and May,
- The moisture content during windrowing storage and the quality of the chip with different degrees of moisture are now under evaluation.
- The new harvesting chain permit a low soil compaction, especially on clay soil and in rainy winters, less storage problem and to enlarge the harvesting period, in other words TO DECREASE THE ENVIRONMENTAL IMPACT OF THE AGRO-ENERGY SYSTEM.

Sustainable crop production

There are two scenarios for the GHG emissions in 2100; 450 ppm or 550 ppm. All the efforts should focus on the first scenario (450 ppm). Even if the GHG emissions managed to be stabilised at 450 ppm there is only a 50% chance of keeping global temperature rise below 2^0 C.

The main opportunities of Biomass to become saviour are: the iincreased security of energy supply (US), greenhouse gas mitigation potential (EU), supports

sustainable development (DCs), used for treatment of organic wastes, provides employment opportunities, it is a relatively cheap store of energy, it is a trade able energy carrier and product, can produce multi- and co-products, and can be used to physically reduce atmospheric CO_2 concentrations.

The future transition to a "*Bio-economy*" will be accomplished with the involvement of the national and state governments, the partnerships between the private/public sectors, the Energy industry, the Agricultural industry, the Bio-technology industry, the local governments, etc.

Facts that should taken under consideration regarding the sustainable crop production:

- Climate change is real and adaptation is inevitable.
- How agricultural production will be affected is uncertain but more droughts, floods etc. are likely.
- The *sins* of biomass crops grown for materials, fibres, energy and chemicals can mostly be forgiven - by careful management of the land and water and by improving the various conversion processes.
- Closer liaison is needed between those producing feedstocks and those processing them. It should be pointed out that "we are running out of time.

Energy and agriculture production – Sustainability of biofuels

Even though the recent energy production from agriculture had a very small influence on recent food crises there are many question about the sustainability rules that bioenergy follows so far and many questions about the future threats from bioenergy.

Issues that should be taken under consideration:

- The use of all the organic wastes and plant residues as feedstock (energy, chemicals, fiber, building material, compost), and plus an annual increase of crop productivity (~2%), are needed to secure food, feed and biofuel production.
- Besides the appropriate international food security policy, measures have to be addressed on a regional scale, because of the uneven distribution of natural resources; especially land and water.
- It is positive and to the right direction, the measures taken by E.U. in its last directive 11-12 December 2008, on R. Energies (The year 2020, Energy from RES in **all** E. Countries should be 20%). In these 20% RES target, Biomass is expected to contributes by 12,5% (EREC 2008)
- E. Union regulation, supports also the use of feedstock **not designated for food** and respecting the **new sustainability criteria,** saving initially at least 35% of CO2, and up to 2017 more than 50%, with the existing installations (<1/4/2013), and more than 60%, for the new installations.
- Bioenergy feedstock should not produce: 1) in land of high biodiversity, 2) from natural forests 3) from places of high C concentration (Savannas, Peat etc.)
- In any case, the cost of biofuels will continue to be tightly related, first with the prices of fossil fuels and secondly with the food, feed, and fiber prices.

Can the production of the non-food crops be economically viable? A case of arable land reallocation in Greece

After the latest CAP reform farmers are free to choose what to grow based on economic considerations. As high subsidies have been removed from several conventional crops, energy crops look now more efficient in financial terms.

The CAP reform caused reduction on the cultivation of arable land was 10% (between 1999 and 2003 CAP). The arable land in 2000-2 was 2726 million ha and

2548 million ha in 2007. Under the new CAP, choices regarding arable land allocation must be based on economic logic. Farmers are still surviving thanks to the temporal decoupled subsidy that they receive. However, they know that sooner or later they will have to take more permanent decisions.

Cotton has been cultivated in Greece for many years. Lately, together with tobacco had become the most generously subsidised crops in Europe. Until 2005, the cotton subsidy was twice the international selling price. After the implementation of the reformed CAP-2003, the coupled subsidy is just sufficient to leave a small profit to the most effective cotton producers. As a result, in the following years, cotton areas will be resulted to almost half. Greek farmers, anticipating further reductions in the subsidies received, are seeking more stable solutions for their farms.

Although cultivated in relatively small area, tobacco was traditionally one of the most outstanding crops of Greece. Its significance for the social and economic life of some of the poorer regions of Greece was high. Tobacco production in Greece has fallen by 80 percent since 2006 and the number of growers has shrunk from around 50,000 to 15,000 tonnes. In Northern and Central Greece there is increasing interest in new cropping opportunities after the release of forty thousand tobacco cultivated hectares.

For the economic analysis and for the non-food crops used the break-even price (break-even price is the selling price of the crop at which it gives the same profit per hectare as the competing alternative plantation). The aim of this was to compare the arable crops situation as it appears in the eyes of the farmer. In 2030 we expect another reform so subsidies may be even less.

In Durum wheat the prices fluctuated a lot. Two years ago the price was too high then was declined and now starting to increase again.

The sensitivity analysis shown that range of figures is too wide. The yields varied a lot depending upon location and cultivation treatments. The production cost may also vary significantly due to size and location, more or less irrigation, etc. Therefore, when treating individual cases, one must be more specific in order to avoid uncertain generalisations.

Round table discussion

During the round table discussion several questions were raised that the most important were: ***can the production of non-food crops be sustainable*, how to manage targets in each country, *how to measure biodiversity*, *should we focus on biorefinery*, *etc*.**

Concluding workshop points:

- Massive opportunities for several crops and products existed in EU.
- There are many policies around Europe and the question is how all these policies will be integrated.
- A methodology is needed to pass the information up.
- Farmers are not stupid.
- The farmers and the policy makers need to enhance what the scientists produce.
- Some products have great environmental benefits.
- The people are reluctant to chance because in most of the cases they do not know.