www.crops2industry.eu

Nature wins!

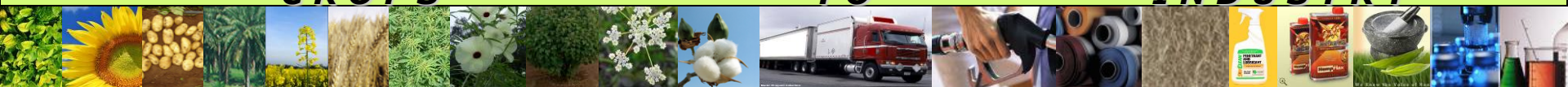
Crops2Industry

"Non-food Crops-to-Industry schemes in EU27"

Mark Reinders Msc.
Vice President
HempFlax companies

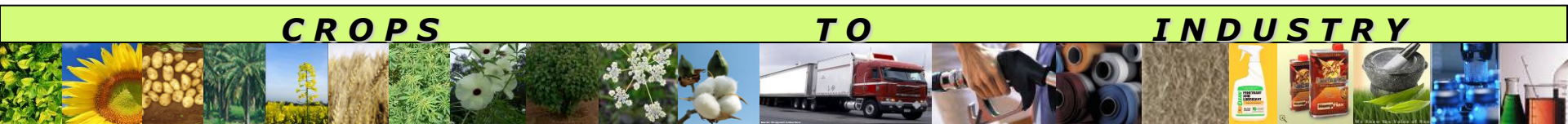
9th International Conference of the European Industrial Hemp Association, May 23th-24th 2012, Wesseling

CROPS TO INDUSTRY



The overall objective ***is*** to **explore the potential of non-food crops**, which can be domestically grown in EU27 context, **for selected industrial applications**, namely oils, fibers, resins, pharmaceuticals and other specialty products **and outline and prioritise crops-to-products schemes**, suitable for the different Member States, which will support sustainable, economic viable and competitive European bio-based industry and agriculture.

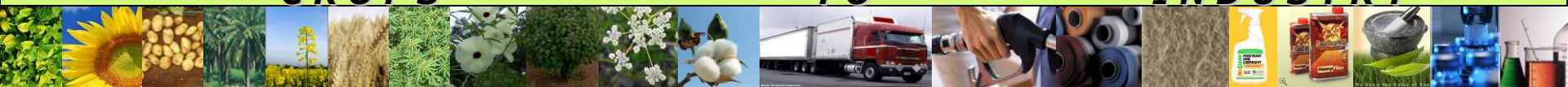
The expected output will be to identify whether and under which terms Europe has the potential and the technical competence to develop a competitive bio-industry fed by a sustainable agriculture.



The consortium

CRES - Centre for Renewable Energy Sources, Greece	**Crops**
UNIBO - University of Bologna, Italy	
INF&MP - Institute of Natural Fibres and Medicinal Plants, Poland	
BIOS – BIOS AGROSYSTEMS S.A., Greece	
NCPRI – National Institute for Chemical and Pharmaceutical Research and Development, Romania	
ITERG, France	**Industry**
KEFI – Kenaf Eco Fibers Italia S.p.A, Italy	
Hempflax B.V, The Netherlands	
CHIMAR Hellas S.A, Greece	
AUA - Agriculture University of Athens, Greece	**Biotechnology**
ICCEPT – Imperial College London, UK	**Economics**
OeKO – Institut of Applied Ecology, Germany	**Sustainability**
BOKU – University of Natural Resources and Applied Life Sciences, Austria	
FZ-JUELICH Forschngszentrum Julich GmbH, Germany	**Overall assessment**

CROPS TO INDUSTRY



The concept

Oil Crops

Fibre Crops

Carbohydrate Crops

Other Specialty Crops

Crop2Industry

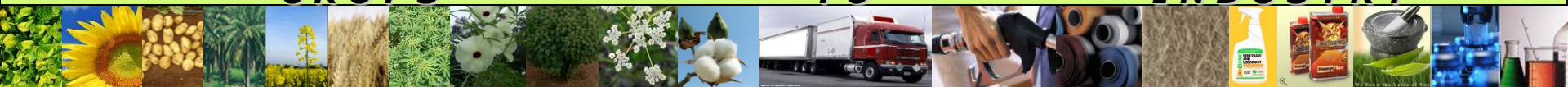
Oils

Fibres

Resins

Pharmaceuticals and other specialty products

CROPS TO INDUSTRY



Project structure

WP7. Dissemination

WP6. Overall assessment

WP1. Non-food crops

Oil Crops

Fibre Crops

Carbohydrate Crops

Other Specialty Crops

Crop2Industry

WP3. Bio-based products

Oils

Fibres

Resins

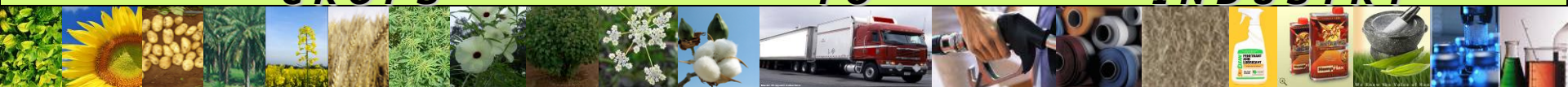
Pharmaceuticals and other specialty products

WP2. Plant breeding

WP4. Costs and socio-economic impacts

WP5. Sustainability standards

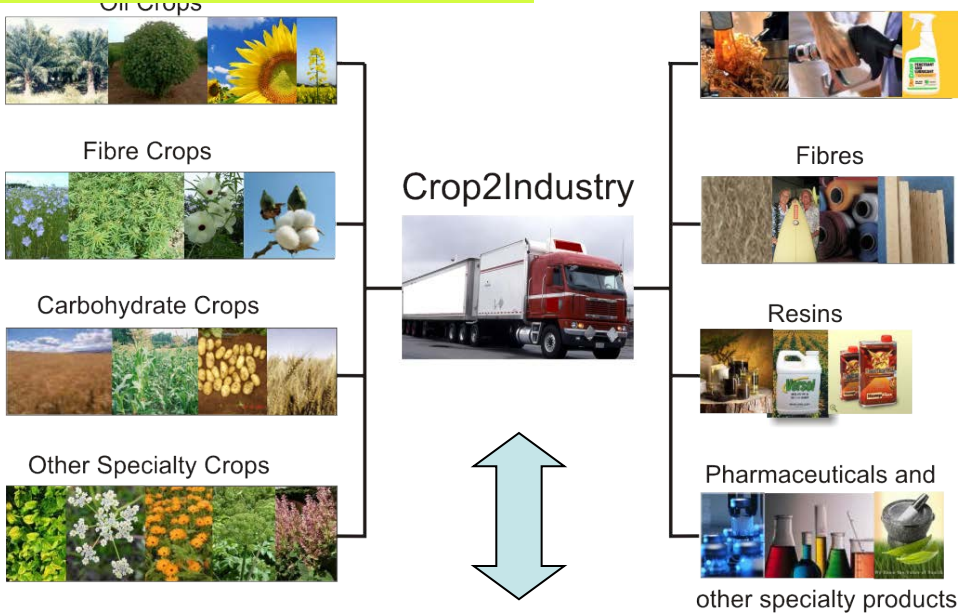
CROPS TO INDUSTRY



Project structure

WP1. Non-food crops

WP3. Bio-based products



WP2. Plant breeding

WP4. Costs and socio-economic impacts

WP5. Sustainability standards

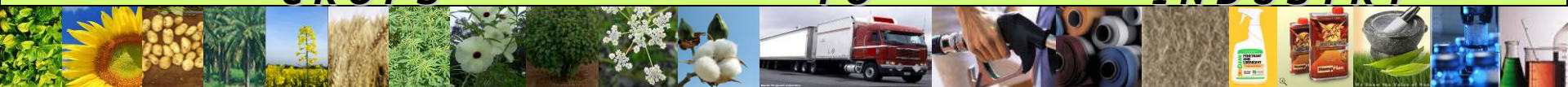
WP7. Dissemination

WP6. Overall assessment

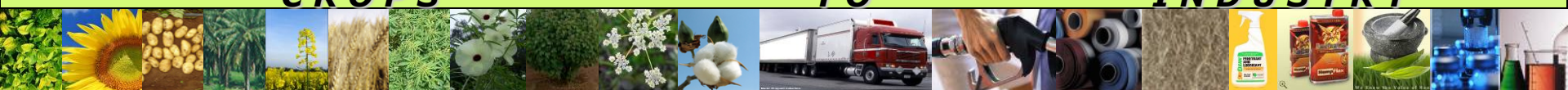
Project activities

WP1. Non food crops

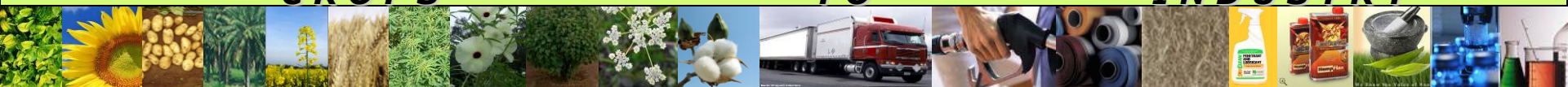
- Reviews for a wide range of non-food crops, that are/could be grown in Europe,
  - plants anatomy,
  - areas of origin and cultivation,
  - growing conditions,
  - harvesting and logistics,
  - yields, quality,
  - applications,
  - factors restricting growth and yielding potential,
  - research gaps and recommendations.
- Available lands for the cultivation on food/non-food crops in Europe now, in 2020 and 2030.



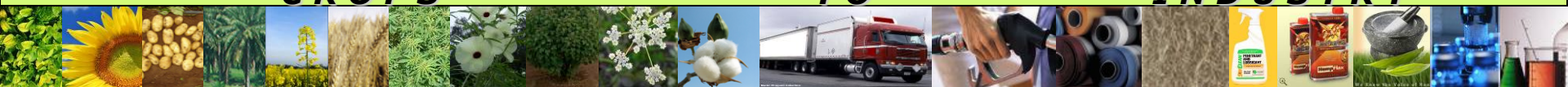
Oil Crops
1. Calendula/pot marigold (*Calendula officinalis*),
2. Caper spurge (*Euphorbia lagascae*),
3. Cardoon (*Cynara cardunculus*).
4. Castor (*Ricinus communis*),
5. Cotton seed (*Gossyium annum*),
6. Crambe (*Crambe abyssinica*),
7. Cuphea (*Cuphea spp.*)
8. Ethiopean mustard (*Brassica carinata*),
9. Honesty (*Lunaria biennis*),
10. Jatropha (*Jatropha curcas*)
11. Linseed/flax (*Linum usitatissium*),
12. Rapeseed (*Brassica napus*), incl HEAR
13. Safflower (*Carthamus tinctorius*)
14. Sunflower (*Helianthus annus*)incl high oleic



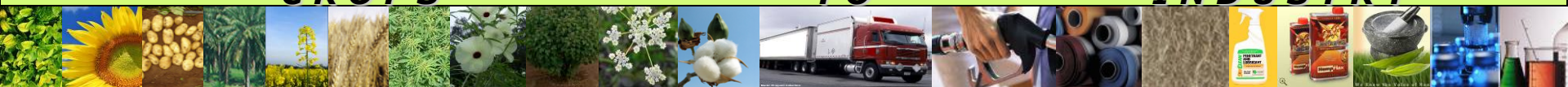
Fiber Crops
1. Banana (*Mussa spp* L)
2. Fibre flax (*Linum usitatissimum* L)
3. Giant reed (*Arundo donax* L.)
4. Hemp (*Cannabis sativa* L)
5. Kenaf (*Hibiscus cannabinus* L)
6. Loofah (*Luffa cylindrica* L.)
7. Miscanthus (*Miscanthus x giganteus* GREEF et DEU)
8. Nettle (*Urtica dioica* L)
9. Reed canary grass (*Phalaris arundinaceae* L)
10. Yucca (*Yucca gloriosa* L)



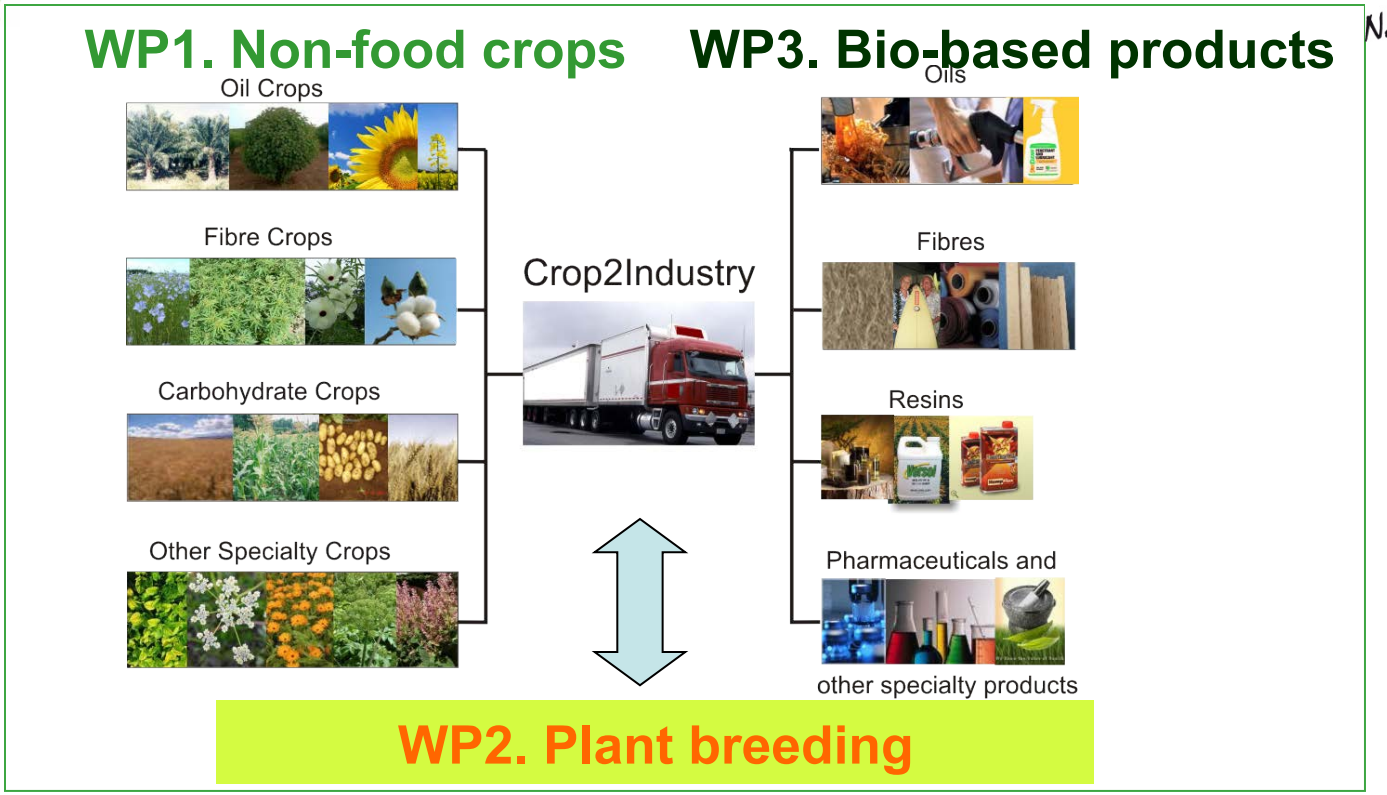
Carbohydrate Crops
1. Cassava (*Manihot spp* L.)
2. Potato (*Solanum tuberosum* L)
3. Sugar beet (*Beta vulgaris* L.)
4. Sweet sorghum (*Sorghum bicolor* L)
5. Maize (*Zea mays* L)



Other specialty Crops
1. Calendula/pot marogold (*Calendula officinalis* L.)
2. Coneflower (*Echinacea angustifolia* DC)
3. Lavender (*Lavandula angustifolia* Mill.)
4. Pepermint (*Mentha x piperita* L.)
5. Ribwort/plantain (*Plantago lanceolata* L.)



Project structure



WP7. Dissemination

WP6. Overall assessment

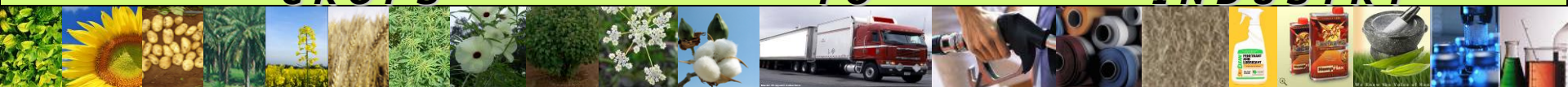
WP4. Costs and socio-economic impacts

WP5. Sustainability standards

Project activities

WP2. Plant breeding

- Review on current molecular genetic technologies (genomic and biotechnological tools and potential applications in a crop-specific manner to address a wide range of breeding constraints
- Review on genetic tools currently available for selected crops to identify, understand and possibly control mechanisms involved in yielding performances, quality adaptation to biotic/abiotic stresses, etc
- Design of breeding strategies for selected crops
- Identification of the most relevant new technologies potentially useful for breeding, production and processes.



Project structure

Nature wins!

WP7. Dissemination

WP6. Overall assessment

WP1. Non-food crops

Oil Crops

Fibre Crops

Carbohydrate Crops

Other Specialty Crops

Crop2Industry

WP3. Bio-based products

Fibres

Resins

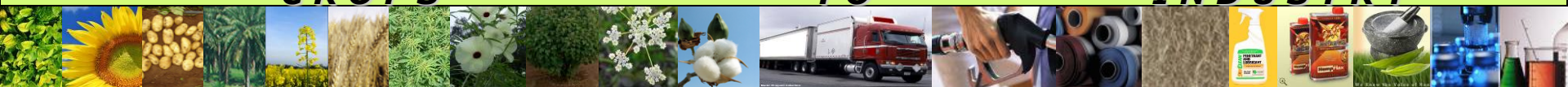
Pharmaceuticals and other specialty products

WP2. Plant breeding

WP4. Costs and socio-economic impacts

WP5. Sustainability standards

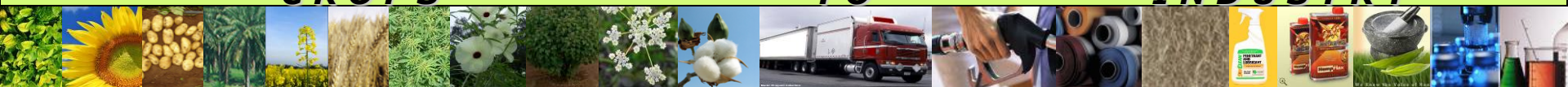
CROPS TO INDUSTRY



Project activities

WP3. Bio-based products

- Reviews for a wide range of high-value biobased products, including
  - size of each market,
  - desirable quality characteristics of feedstock,
  - current alternative resources (including petroleum-based or chemical counterparts) for each use,
  - prospects to widen the range of potential feedstocks based on the technology improvements,
  - restricting factors that inhibit broader industrial use of the biomass feedstocks (supply, costs, physical traits, consistency in quality,
  - research gaps, prospects and recommendations to procure bio-based products will be tackled.



WP3. Bio-based products

Oils

Biodiesel

Lubricants

Paint and ink

Polimers

Fibers

Nonwoven, insulation,

Composites

Pulp & paper

Technical fabrics

Decorative fabrics, twine, ropes

Particleboard

Woven and knitted fabrics, garments

etc

Resins

Cellulose

Hemicellulose

Lignine

Protein

Tannin

Starch

Free sugars

Natural oils

Specialty ingredients

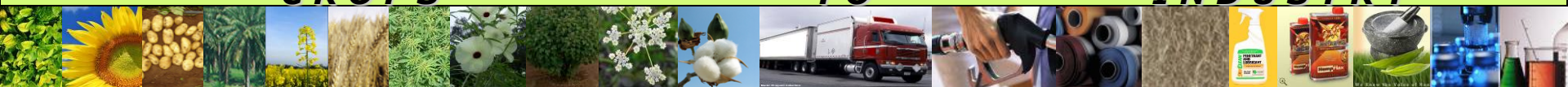
Other specialties

Pharma industry

Cosmetics

Dyes, colourants

Insecticides



Project structure

WP7. Dissemination

WP6. Overall assessment

WP1. Non-food crops

Oil Crops

Fibre Crops

Carbohydrate Crops

Other Specialty Crops

Crop2Industry

WP3. Bio-based products

Oils

Fibres

Resins

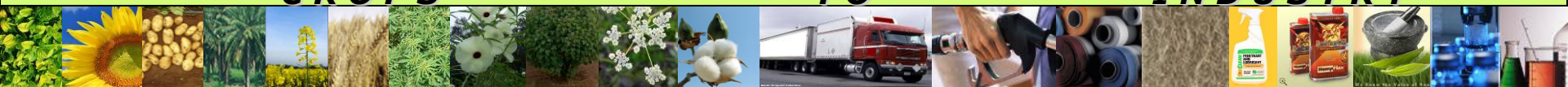
Pharmaceuticals and other specialty products

WP2. Plant breeding

WP4. Costs and socio-economic impacts

WP5. Sustainability standards

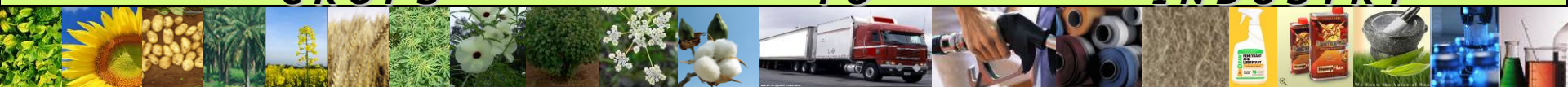
CROPS TO INDUSTRY



Project activities

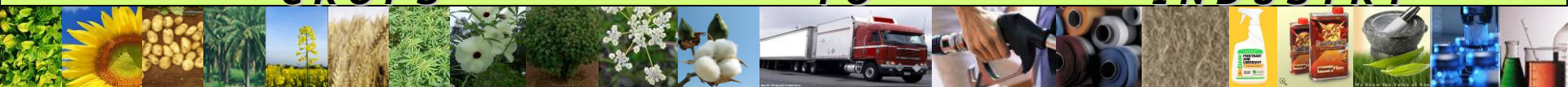
WP4. Costs and socio-economics

- Cost analysis of supply chains and socio-economic assessments of full chain crop-to-product and co-products
- Best business opportunities for selected crop-to-product schemes at EU27, regional and country levels
- Prioritisation of crop-to-product schemes in terms of their economic profitability



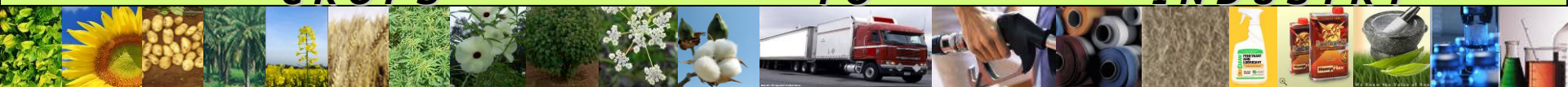
Best business opportunities

Oil	• Current: Rapeseed & sunflower • S-M future: Linseed & Cardoon
Fiber	• Current: Flax • S-M future: Hemp, fiber sorghum & kenaf
Carbohydrate	• Current: Maize, wheat, sugarbeet & potato • S-M future: Sweet sorghum, topinambour
Specialty	• Current: Pot marigold; peppermint • S-M future: Echinacea



Best business opportunities

South	Central	North
Sunflower Cardoon	Rapeseed Linseed	Rapeseed Linseed
Fiber sorghum Kenaf	Flax Hemp/ F sorgh	Flax Hemp
Maize Sweet sorghum	Maize Topinambour	Maize Topinambour
Peppermint Echinacea,…	Calendula Echinacea, …	Peppermint Echinacea,…



Project structure

WP7. Dissemination

WP6. Overall assessment

WP1. Non-food crops

Oil Crops

Fibre Crops

Carbohydrate Crops

Other Specialty Crops

WP3. Bio-based products

Oils

Fibres

Resins

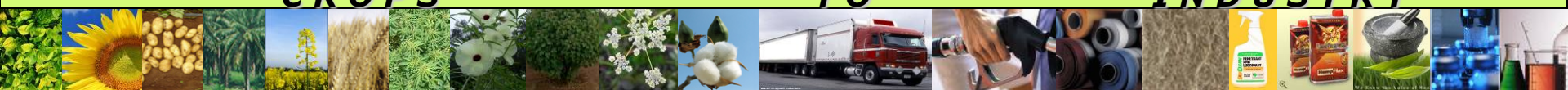
Pharmaceuticals and other specialty products

WP2. Plant breeding

WP4. Costs and socio-economic impacts

WP5. Sustainability standards

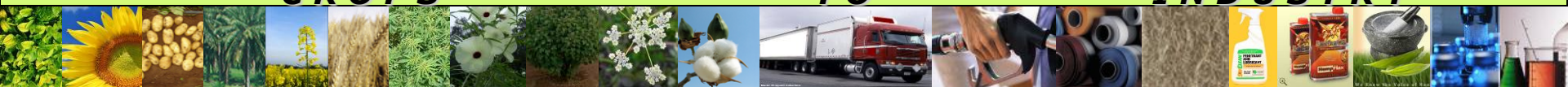
CROPS TO INDUSTRY



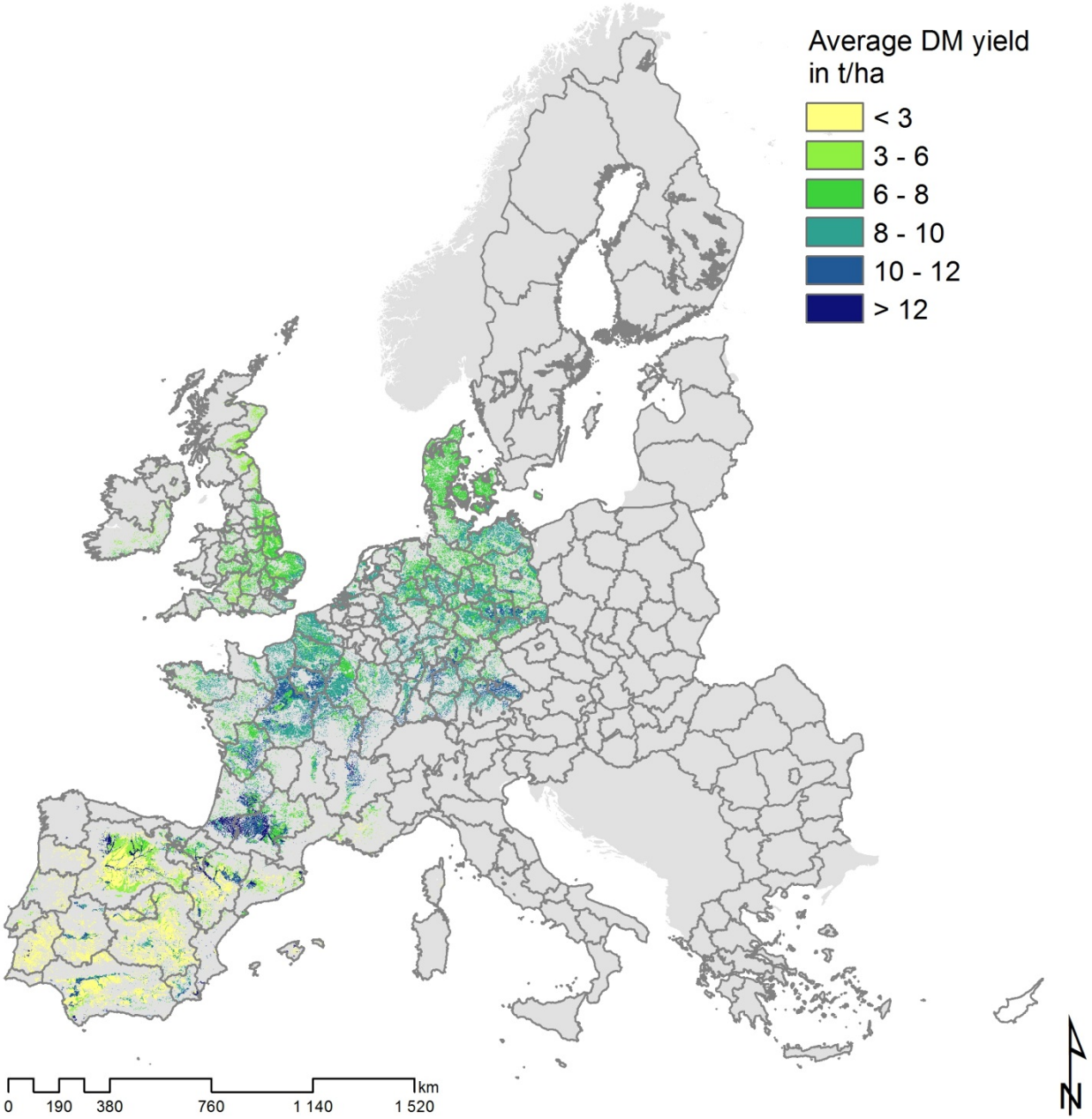
Project activities

WP5. Sustainability standards

- Maps of production indicators for selected non-food crops (e.g crop and biomass yields)
- Maps of environmental indicators for selected non-food crops (e.g. soil organic carbon, nitrate leaching, gaseous emissions) for EU27
- Challenges and conflict areas for non-food production systems
- Set-up of a core list of sustainability standards and criteria

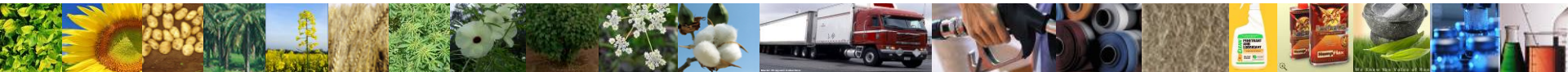


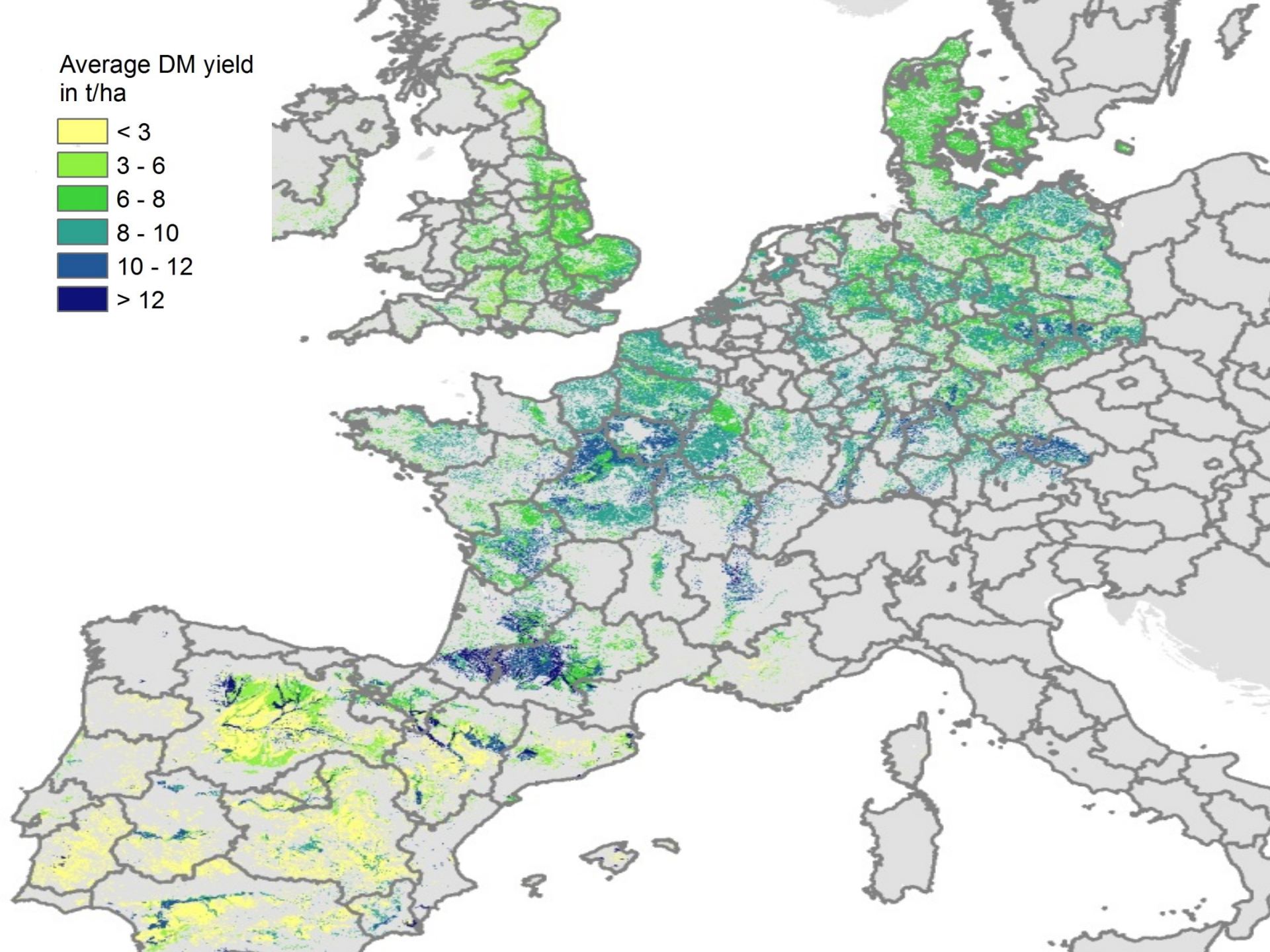
Hemp



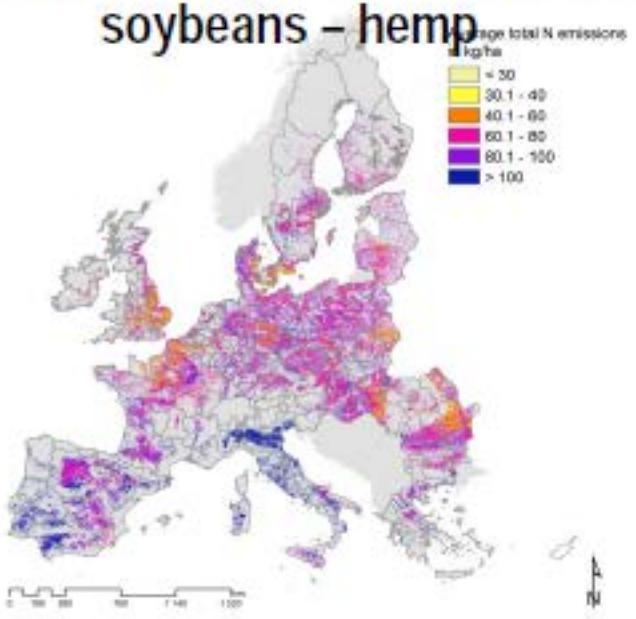
HEMP FLAX®

Nature wins!

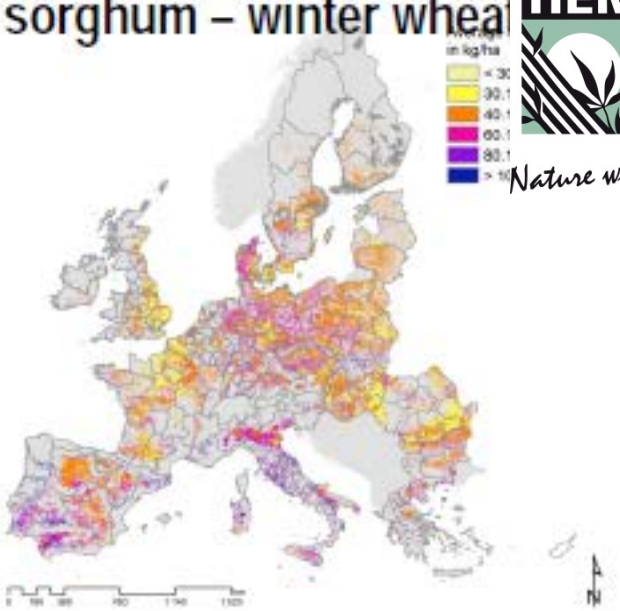



Average DM yield
in t/ha
< 3
3 - 6
6 - 8
8 - 10
10 - 12
> 12

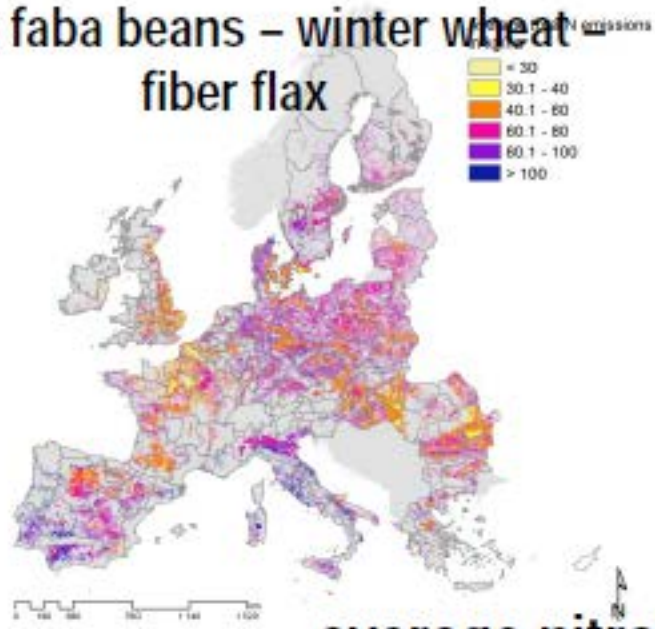
CRS1: sweet sorghum – winter wheat – soybeans – hemp



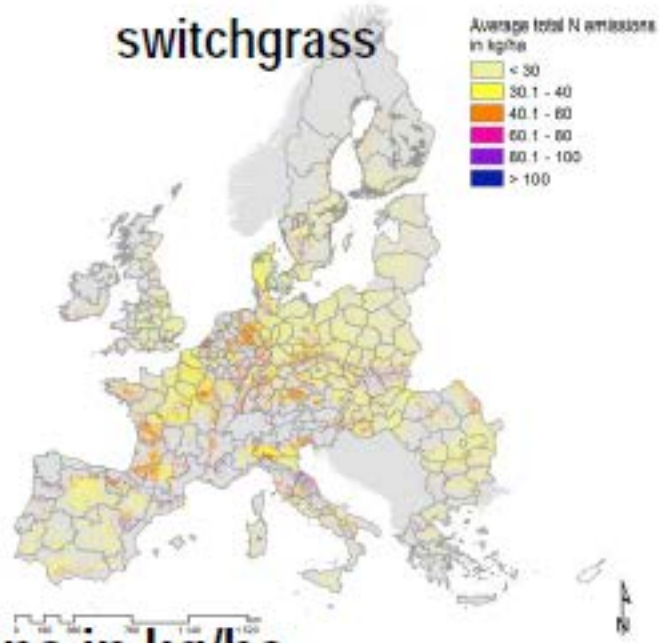
CRS2: corn – sunflowers – sweet sorghum – winter wheat



CRS3: faba beans – winter wheat – fiber flax



switchgrass



average nitrogen emissions in kg/ha

HEMP FLAX®
Nature wins!

Project structure

WP7. Dissemination

WP1. Non-food crops

Oil Crops

Fibre Crops

Carbohydrate Crops

Other Specialty Crops

Crop2Industry

WP3. Bio-based products

Oils

Fibres

Resins

Pharmaceuticals and other specialty products

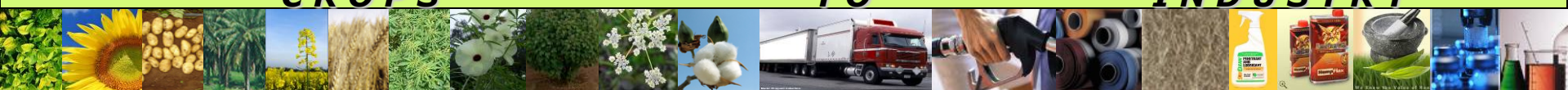
WP2. Plant breeding

WP4. Costs and socio-economic impacts

WP5. Sustainability standards

WP6. Overall assessment

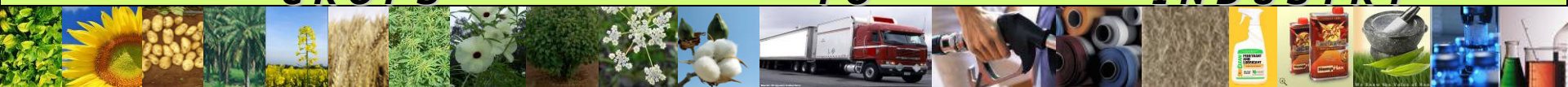
CROPS TO INDUSTRY



Project activities

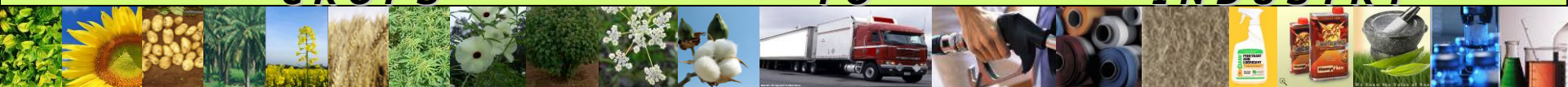
WP6. Overall assessment

- Set up of a core list of criteria for the integrated environmental and economic assessment to help selecting and prioritizing non-food crops
- Identification of major technical and non-technical bottlenecks to define system boundaries, possible solutions and steps to go forward
- Identification and prioritization of the most important crops-to-product schemes for the EU industry



Set up of criteria

- **Bioproducts**
  - **Existing Markets**
    - Potential to increase market share
    - Availability (Prod./ Proc.)
    - Diversification
    - Appropriate business models
  - **New crops/ markets**
    - Effort to develop crop
    - Novel technologies needed
    - Characteristsics of new market



Identification of bottlenecks and of potential solutions

Major bottleneck categories

Availability: quantity and quality

- crop
- Land
- climate change
- Seasonality
- Crop rotation
- New business development

Competition with fossil-base/ existing products

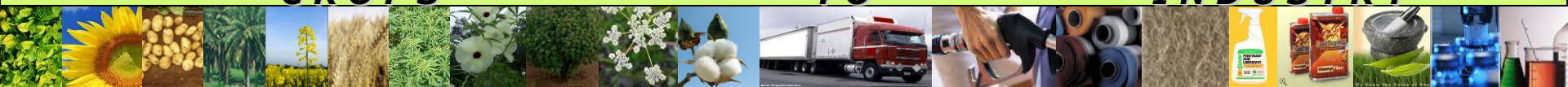
- Cost of raw material
- Technology and integrated systems
- Existing infrastructures
- Traditional business cases/ relations

Public regulation and perception

- Public perception
- Regulatory issues and support by public bodies

<u>Different roles for stakeholders for solutions</u>

Farmer, industry, politics/ regulation, academia



Project structure

WP1. Non-food crops

Oil Crops

Fibre Crops

Carbohydrate Crops

Other Specialty Crops

WP3. Bio-based products

Crop2Industry

Oils

Fibres

Resins

Pharmaceuticals and other specialty products

WP2. Plant breeding

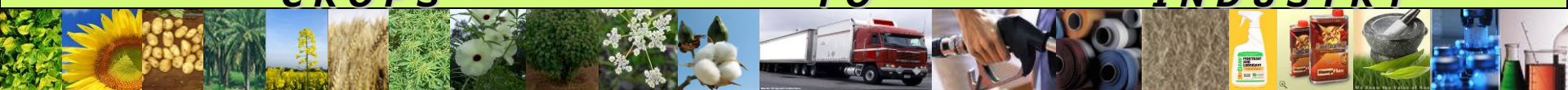
WP4. Costs and socio-economic impacts

WP5. Sustainability standards

WP6. Overall assessment

WP7. Dissemination

CROPS TO INDUSTRY

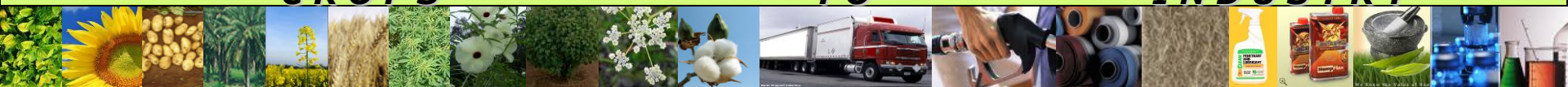


Project activities

WP7. Dissemination (www.crops2industry.eu)

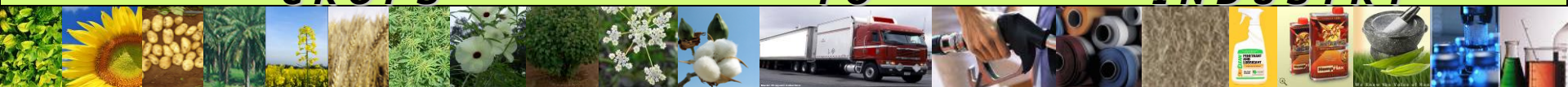
Thematic workshops

- Can fibre crops offer a viable alternative land use option? (Poland, 18/11/09)
- Carbohydrate crops and the dilemma of using them for non-food purposes (The Netherlands, 12/3/10)
- Can oilseed crops offer a sustainable alternative for bio-based industrial products? (France, 18/2/11)
- Niche markets for specialty industrial crops (Greece, 2/9/11)
- Non-food crops for a bio-based Industry and sustainable agriculture (Bologna, 31/1/2012)



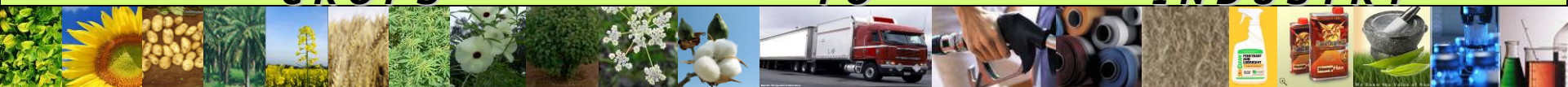
Some conclusions

- The shortage of science and technology does not seem to be an issue but putting the supply chain together and attract the market, which is fed by imports of low-cost raw material, is the real challenge. However, research on improving crop yields and technology efficiency is still imperative.
- Consistency in feedstock and bio-product, poses challenges for speciality products or special feedstocks (in terms of chemicals).
- A structure for prioritisation of the uses of main products and by-products is needed. The biorefinery concept is recommended because it improves the overall efficiency of the industrial plant by exploring all by-products for several uses.
- From the industrial part, more innovation in product development is needed, in order to promote investments.



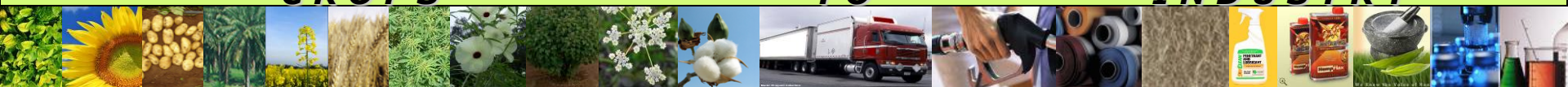
Some conclusions

- To attract investors the projects have to be bankable, else the investor is not going to have any support from the banks.
- Low prices of biomaterials will certainly attract customers
- Assessment of cost variables is required in order to estimate profits of the investments. Market appraisal and sensitivity of the costumers to the product quality and price is required in order to promote investments.
- Profitability is a decisive motive for crops to be cultivated. Which crops to grow depends on the latitude, security of supply, sustainability criteria and its final uses.
- As there are big markets, like the biofuels, and with small markets, like plastics, detailed business plans for crops are crucial. Bioenergy as a product is easy. The high value of low tonnage products shouldn't be overlooked.



Some conclusions

- CAP impact is huge. Any investment decision need long term financial stability. Social motives may still be in need for subsidies. Biomass need the same playfield as the other renewable, thus subsidies have to be put in the right direction and there must be a clear plan on how to remove them, because crop financial profitability should stand alone.
- Security of investment is a long-term EU - governmental issue. We have to pass the message to policy makers that we need stability of science and stability of investment.
- For all the above reasons, public awareness has to be increased. Targeted workshops open to all relevant stakeholders, from farmers to end-users are important for the industry as well as for the investments.



Crops 2 Industry

HEMP FLAX®

Nature wins!

Thank you for your attention and your presence at the conference!

For more information: www.crops2industry.eu