Contextualization of MAGIC & PANACEA projects. Presentation of the most promising alternative crops to be introduced in Europe areas and the available on-line tools. ”

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2/11/20
• **MAGIC** is a research and innovation project (RIA, ~6.000.000 €) started in July 2017 and will run for 54 months, 25 partners, [www.magic-h2020.eu](http://www.magic-h2020.eu)

• **PANACEA** is a thematic network (CSA, ~2.000.000€) started in November 2017 and will be completed at the end of February 2021, 14 partners, [www.panacea-h2020.eu](http://www.panacea-h2020.eu)

• Both projects working on **industrial/non-food crops** for bio based products and bioenergy.

• In the case of MAGIC emphasis has been given to the growing of industrial crops on **marginal lands** (included contaminated by heavy metals).
MAGIC aims to promote the sustainable cultivation of industrial crops on marginal lands

**INDUSTRIAL CROPS**
primarily grown for industrial applications rather than food and feed uses

- **Oil crops** (crambe, camelina, castor, safflower, rapeseed, sunflower, tobacco, etc.)
- **Lignocellulosics crops** (perennial crops/grasses, fiber crops, woody species)
- **Carbohydrate crops** (sweet sorghum, sugarbeet, corn, cassava, potato, etc.)
- **Speciality crops** (calendula, lavender, peppermint, coneflower, ribwort plantain, etc.)

**On MARGINAL LANDS**
for:

- Increased and resource-efficient feedstock with low ILUC for biobased economy
- Diversified and increased farmers' income

MAGIC is working on marginal lands facing natural constraints according to JRC report, which categorizes the marginal lands on criteria based on climate (low and high temperatures, dryness, wet soils, etc.), soil (unfavorable soil texture, rooting depth, etc.) and terrain (slope).
Why to grow industrial crops on marginal lands?

**Industrial crops** contribute:
- a) to the diversification of farmers’ income and b) to the supply of renewable raw materials

- **Industrial crops** to be grown on marginal land (~1,350,000 ha in Europe) to avoid food vs fuel competition

- **Industrial applications** fostering the biobased economy

- **Climate change mitigation**

**Added value of the end-uses applications**

- Fine or bulk chemicals
- Biomaterials
- Bioenergy
Main objective of PANACEA

PANACEA aims to set up a thematic network that will foster the effective exchange between research, industry, and the farming community, so that direct applicable solutions are widely disseminated and grassroots level needs and innovative ideas are thoroughly captured, in order to design the penetration path of non-food crops into European agriculture.
The concept

Panacea

Driving forces for cultivating NFC
- Increasing need for bio-based industry and bioenergy
- Climate change
- CAP 2014-2010
- Rural renaissance

R&I and Good Practices on NFC
- Large number of EU projects has been funded
- Important innovation has been produced
- Success stories can be found in many sites in EU

Means to boost the PANACEA ambition:
- Value-chains events (regional/national/European)
- Training of the practitioners
- PANACEA platform and website

PANACEA ambition is to design:
- The penetration path of NFC to a knowledge driven agriculture taking into consideration the driving forces and R&I results.
- Roadmaps for NFC at national and EU level.

...following a multi-actor approach

Link with EIP-Agri
- Direct communication with EIP-Agri (practice abstracts)
- Link with existing OG
- Propose a new OG on “NFC and bio-products”
In MAGIC at least three tools are being developed (www.magic-h2020.eu)

- **MAGIC-maps** (Maps with the marginal lands in EU28; recently with Ukraine included)
- **MAGIC-CROPS** database, where data for 37 selected industrial crops is included on morphology, key agronomic issues, qualitative traits and actual and potential uses.
- **MAGIC-DSS** (decision support system) providing information for the MAGIC stakeholders (farmers, industry, etc.)
Which crops are being included in MAGIC-CROPS & MAGIC-DSS?

How the initial selection of 67 industrial crops had been done?

The starting point was an old database for industrial crops that does not exist anymore (like IENICA), the recently completed projects such as 4FCROPS, FIBRA, Crops2Industry and the international literature.

Final selection of the top 20 crops as the most promising ones to be grown on marginal lands

37 crops had been selected to be included in the database of the project

68 industrial crops that had been selected from previous research projects
10 value chains are in progress: miscanthus, switchgrass, camelina, castor, safflower, willow, poplar, industrial hemp, sorghum & lupinus
MAGIC-Marginal Land Maps (7 types)

MAGIC Crop Maps (20 industrial crops)

MAGIC Crops database (1 entry per crop)

Ancillary databases (field trials, economics, etc.)

Decision Support System (MAGIC-DSS)

Country and NUTS3 level
MAGIC-DSS

MAGIC Decision Support System

Marginal lands and industrial crops

Specific Marginal Land Type Maps and Selected Crops
- Climate
- Wetness
- Fertility
- Chemical
- Rooting

Marginal Land Area (km²)
619,182

Agricultural Area (km²)
2,392,797

Avg. Marginal Land (%)
20.55

Potential Industrial Crops
19

Select Statistics by Country
Major geographical/climatic zones in Europe; yellow spots indicate new and established field trials.

Already established trials on perennial crops: all WP4 partners

Small-scale field trials on top 15 industrial crops under different marginality factors: CRES, UNICT, CIEMAT, INRA, UHOH, SILAVA, IBC

Large-scale field trials on top 15 industrial harvesting trials and realistic data for WP5 & 6: CRES, UNIBO, CIEMAT, NOVABIOM, UHOH, SILAVA, IBC

Pot trials: AUA, UNICT, FCT UNL, INFMP
Distribution of agro-ecological zones taken into consideration for the development of marginal land low-input systems for industrial crops across Europe modified from Elbersen et al. (2018a) and Metzger et al. (2005)

<table>
<thead>
<tr>
<th>Environmental Zone (Metzger et al. (2005))</th>
<th>Agro-ecological Zone (AEZ)</th>
<th>Consortium partners with new or existing field trials</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDM - Mediterranean Mountains</td>
<td>1</td>
<td>AUA, CIRMAT, CRRES, FCT UNL, UNIBO, UNECT</td>
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<tr>
<td>MDN - Mediterranean North</td>
<td></td>
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<tr>
<td>MDS - Mediterranean South</td>
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<tr>
<td>ATN - Atlantic North</td>
<td>2</td>
<td>DLO, INRA, NOVA BIOM</td>
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<td>ATC - Atlantic Central</td>
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<tr>
<td>LUS - Lusitanian</td>
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<tr>
<td>BOR - Boreal</td>
<td>3</td>
<td>3B, IBC, INF &amp; MP, SILAVA, UNICHT</td>
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<td>CON - Continental</td>
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<td>NEM - Nimoral</td>
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<td>PAN - Pannonian</td>
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</tbody>
</table>

= Consortium partners

Modified from Metzger et al. (2005)
One more tool in MAGIC...

Demand driven case studies
- **EMPYRO, BTG**: commercial demonstration plant for conversion of biomass into pyrolysis oil (24,000 tons of oil per year; started in 2016; 7 employees; located at Hengelo (The Netherlands))
- **The Saint-Menet Biorefinery, ARKEMA**: 52,000 tons oil per year; started in 1995; 343 employees; occupied 13 ha, located in Marseille (France)
Harvesting trials with camelina and castor in MAGIC project (partner: CREA)
PANACEA platform
(valuable information on projects and non-food crops)
Crop Specific Filters

- More than 200 projects have been included in PANACEA platform, while information for 29 non-food crops will be added (so far 10 crops).
- These 29 non-food crops have been selected by PANACEA are near-to-practice non-food crops.
How the non-food crops information looks like?

Castor bean
Multi-actor projects with emphasis on farmers’ participation through:

• Demo days, training courses, on-line tools, working with farmers, presentation to large exhibitions for farmers, etc.

• A guideline for farmers will be ready at the end of this year on how the industrial crops should be grown on marginal lands (MAGIC).

• A roadmap with the non-food crops that are near-to-agricultural practice will be realized at the end of PANACEA project.

• A large field trials that have been established in MAGIC projects; in some of them in collaboration with farmers.
A focus group has been proposed in EIP AGRI in 2019 dedicated on industrial crops for non-food uses.

The focus group had two meetings in 2020; the first in May 2020 and the second in October 2020.

In this FC > 20 members from scientists, farmers, advisory experts, etc.

Currently five mini-papers are being composing.

At the end of this year a report with the final findings of FC40 will be realized.

Which industrial/ non-food crops are near-to-practice?

**Why to grow industrial crops?**
Need for feedstock for non-food uses (biobased products and bioenergy based industry and market needs)
They can grow on marginal lands without affecting the cultivation area of food and feed crops
Driving forces for growing industrial crops:
- CAP after 2020; National strategic plans
- Directive of Biofuels (RED II)
- Climate Change
- Bioeconomy strategy (circular economy)
- Green Deal

**Success stories of industrial crops**
(miscanthus, hemp, poplar and cardoon) on BBI demo and flagship projects (GRACE, FIRST2RUN, DENDROMASS4EUROPE)

**In BECOOL and COSMOS projects**
selected annual industrial crops (sorghum, camelina, etc.) are grown in rotation with conventional crops.

**MAGIC project**
started from 67 industrial crops and 20 ones have been selected as promising to be grown on marginal lands.

**PANACEA started from 93 non-food crops and 29 crops have been selected as near-to-practice.**

In **PANACEA project** the 29 non-food near-to-practice are: miscanthus*, giant reed, cardoon, industrial hemp, switchgrass, reed canary grass, kenaf, sorghum, flax, carinata, rapeseed HEAR, sunflower, castor, camelina, safflower, eucalyptus, poplar, willow, black locust, sugar beets, lupin, triticale, guayule, Russian dandelion, rosemary, peppermint, lavender and calendula.

In **MAGIC project** the 20 promising industrial crops to be grown on marginal lands are: switchgrass, cardoon, reed canary grass, sorghum, tall wheat grass, castor, miscanthus, giant reed, camelina, safflower, hemp, pennycress, poplar, carinata, willow, wild sugarcane, Siberian Elm, Black locust, crambe and lupin.
Thank you very much for your attention

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