



Best agronomic practices for low ILUC risk biomass feedstock

*BIO4A & BIKE webinar, 23/2/23
“Low ILUC risk feedstock for SAF and soil carbon sequestration in Mediterranean marginal land”*

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ENERGY SOURCES AND SAVING

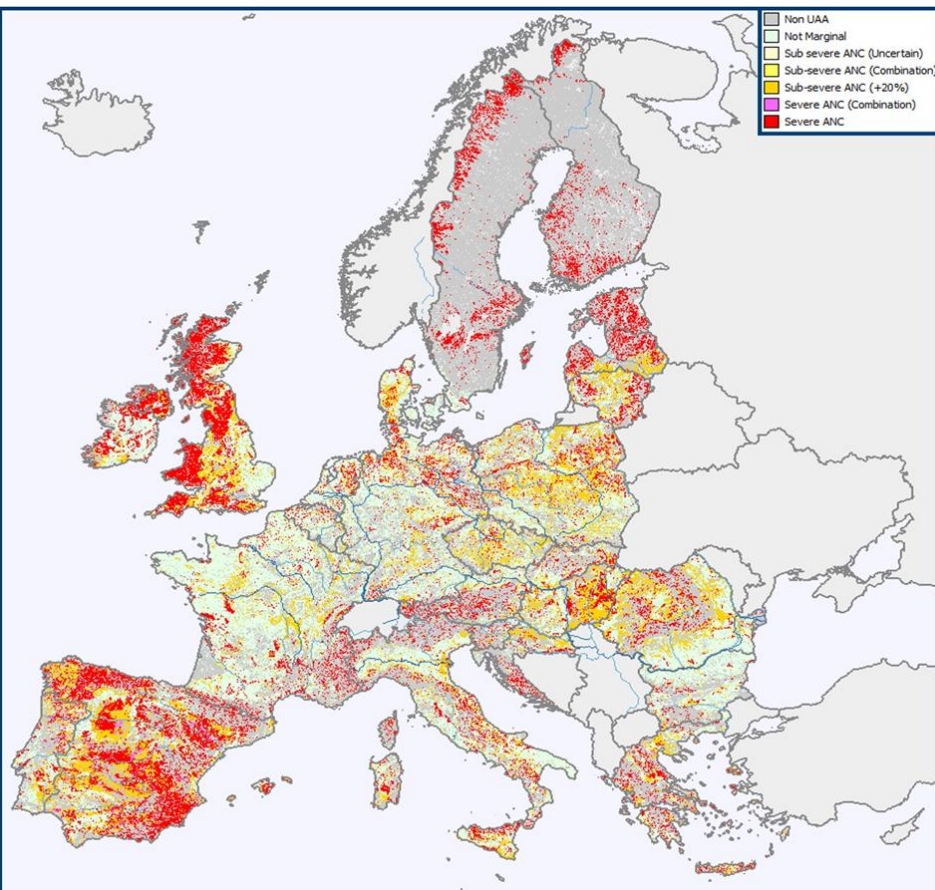


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Marginal lands in the Mediterranean region

According to MAGIC project and the work had been done by Elbersen *et al.* (WR) the marginal land in Med region is 34%.



	1. Adverse climate	2. Excessive soil moisture	3. Adverse chemical comp.	4. Low soil fertility	5. Adverse rooting cond.	6. Adverse terrain	Marginal	Not marginal
Alpine	40%	21%	0%	2%	45%	47%	61%	39%
Atlantic	4%	14%	1%	1%	12%	5%	26%	74%
Continental	1%	5%	2%	1%	5%	2%	14%	86%
Mediterranean	13%	1%	1%	6%	18%	9%	34%	66%
North	62%	14%	0%	3%	13%	3%	71%	29%
Grand Total	11%	8%	1%	2%	12%	6%	29%	71%

But which can be the best agronomic practices for low ILUC risk biomass feedstock in the Mediterranean region

There are two options:

- ✦ Either to cultivation dedicated energy/non-food crops in **unused, abandoned** or severely **degraded land** and/or
- ✦ To grow **dedicated energy/non-food crops in the existing rotation systems without affecting the yields of the conventional food and feed crops** (increase productivity through improved agricultural practices)

In BIKE both options are being tested non-only in MED region



Value Chain Type 1: cultivation in unused, abandoned or severely degraded land

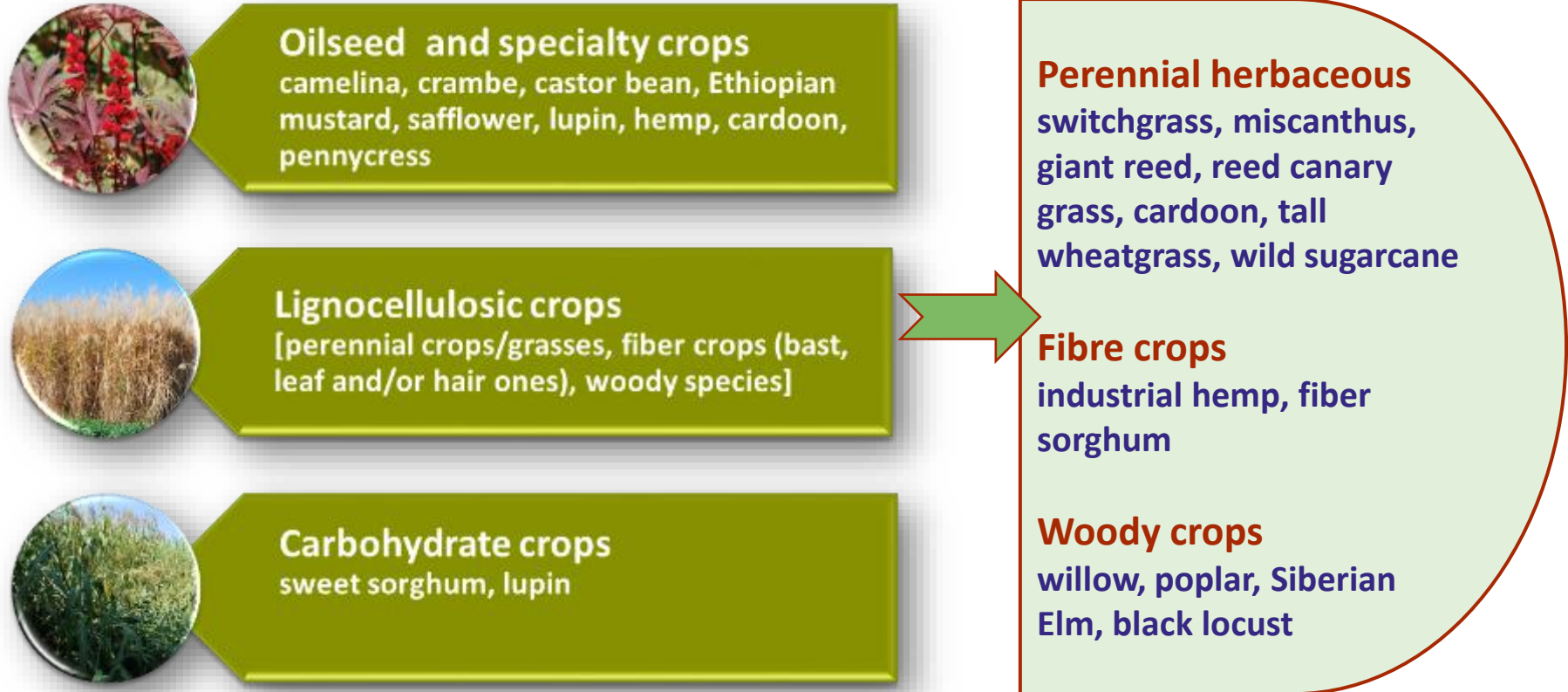
- ✦ Castol oil for HVO (in Italy, Tunisia and Greece)
- ✦ Perennial crops for bioethanol production (in Italy, Greece and UK)



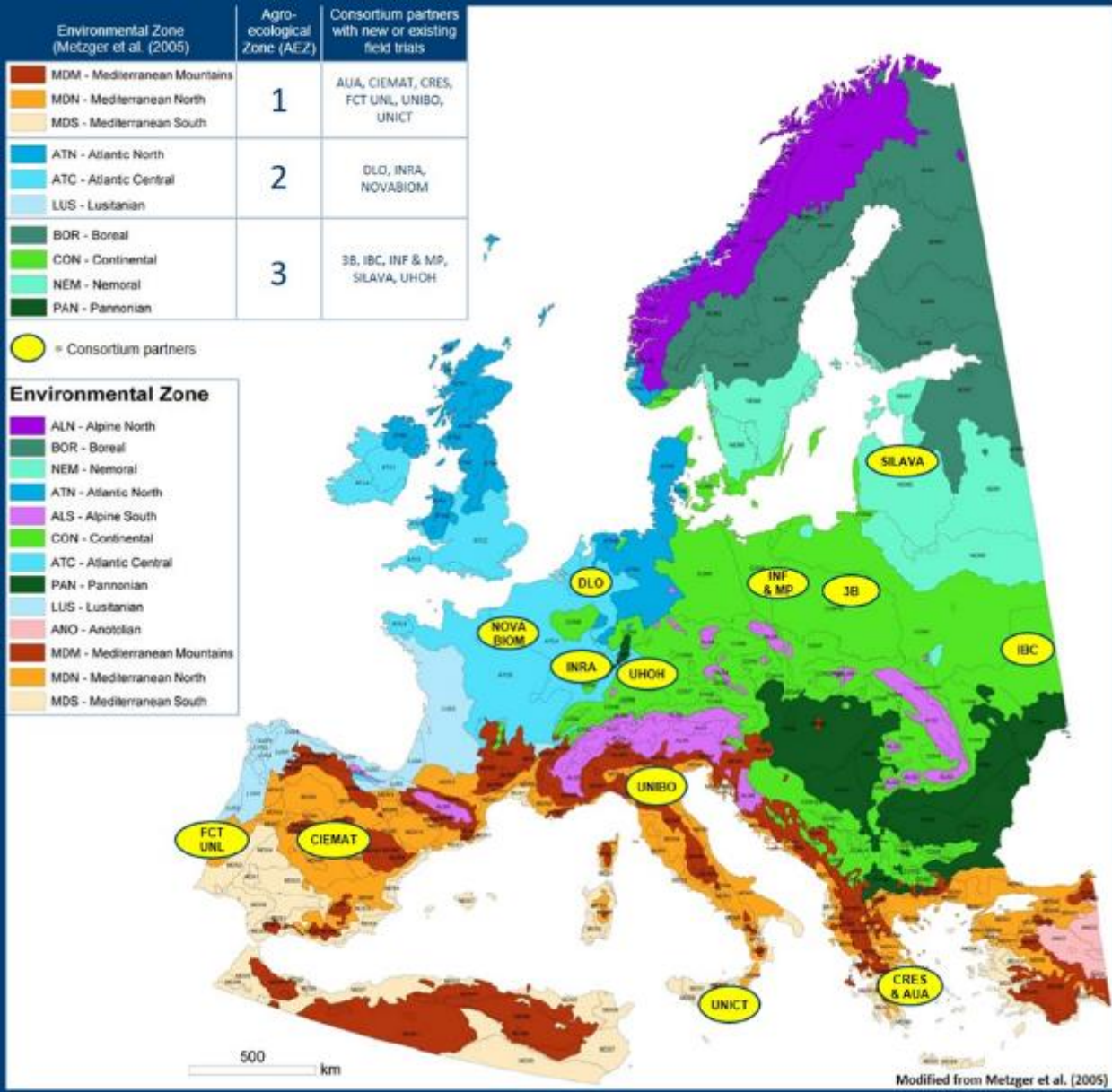
Value Chain Type 2: productivity increases from improved agricultural practices

- ✦ Brassica carinata for HVO (in Italy, Greece and Uruguay)
- ✦ BDR model and further biogas to liquid conversion for F.T. diesel or MeOH production (in Italy; two sites and Greece)

But which energy/non-food crops had been selected as ideal crops to be grown on marginal lands?



- ◆ **20 industrial crops** have been selected in total
- ◆ **8** of them can be grown in all partners of the project (**camelina, crambe, switchgrass, miscanthus, industrial hemp, pennycress, poplar, Siberian elm**)
- ◆ Some of them can be grouped in more than one category (such as cardoon, hemp, etc.).



Selected Industrial crops

Camelina*

1. Crambe*
2. Castor bean
3. Ethiopian Mustard
4. Safflower
5. Pennycrest*
6. Switchgrass*
7. Miscanthus*
8. Giant reed
9. Reed canary grass
10. Cardoon
11. Tall wheatgrass
12. Wild sugarcane
13. Poplar
14. Willow
15. Black locust*
16. Siberian Elm*
17. Industrial hemp*
18. Fiber/sweet sorghum
19. Lupin

*These crops can be cultivated in all Europe.

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)

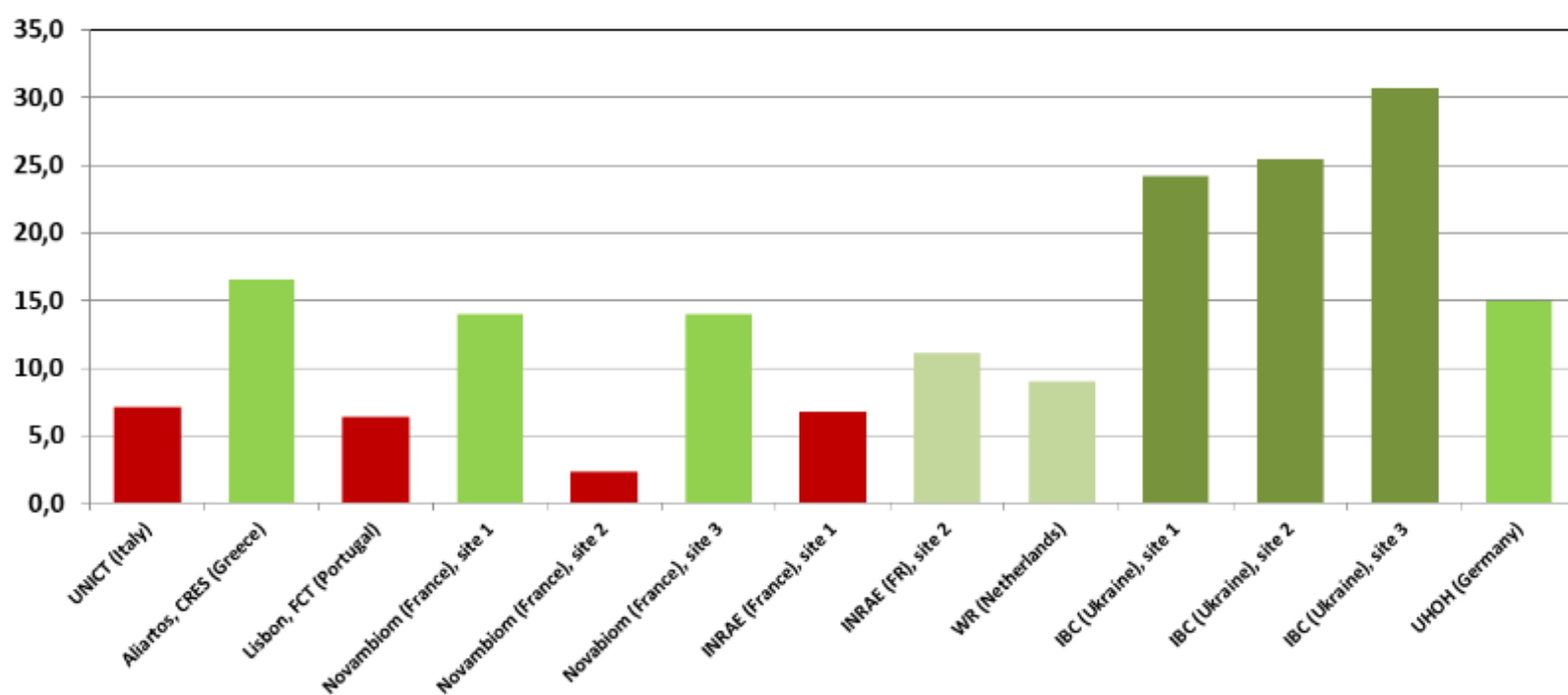
It has been selected by OPTIMA (www.optima.fp7.eu) and OPTIMISC (<https://optimisc.uni-hohenheim.de/en>) projects as a promising crop to be grown on marginal lands. Currently, has been included in GRACE project (www.grace-bbi.eu) to be grown on marginal and/or contaminated lands.

Miscanthus (*Miscanthus x giganteus*) is the energy crop that has been selected by the majority of the EU projects to be grown on marginal lands

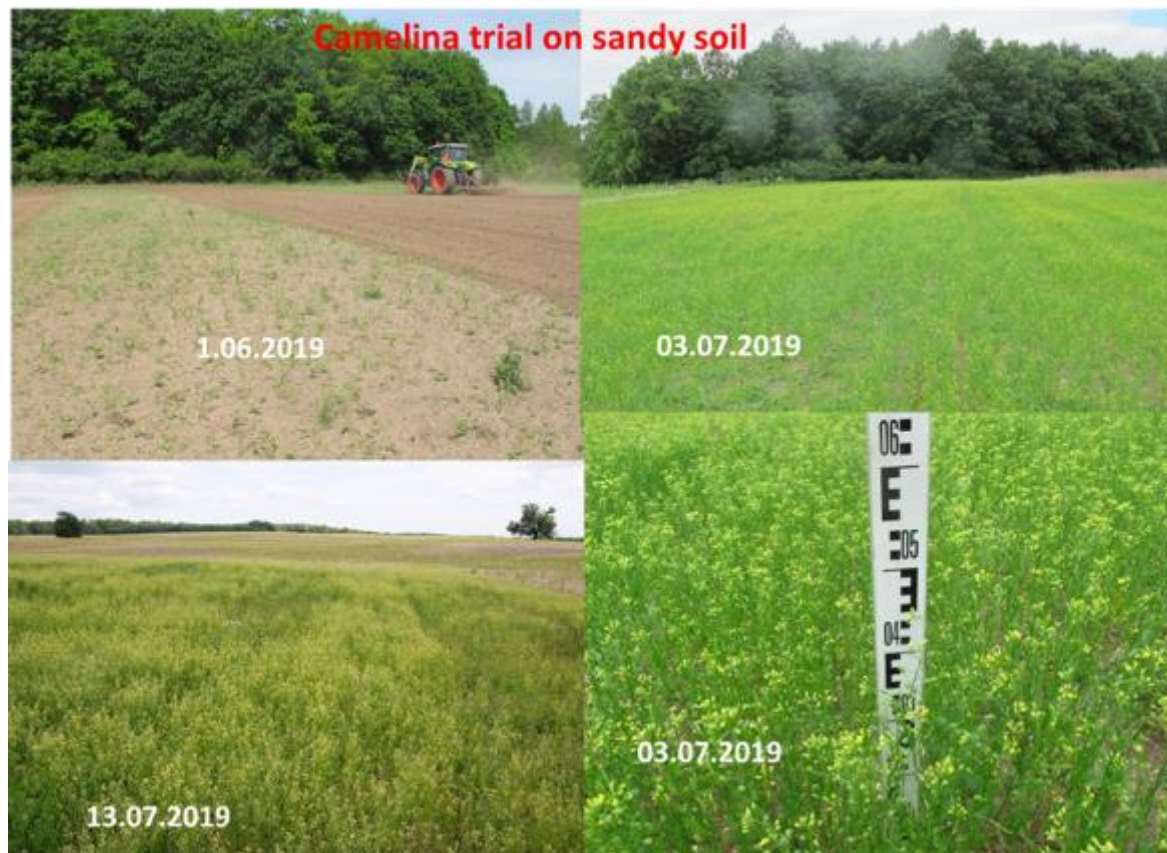
In MAGIC it has been tested on long-term field trials established under dryness, unfavorable soil texture (shallow soil depth, acidity, heavy clay soils), contaminated lands and marginal lands for socio-economic reasons.



Dry matter yields (t/ha)



A increasing interest gain crops like camelina



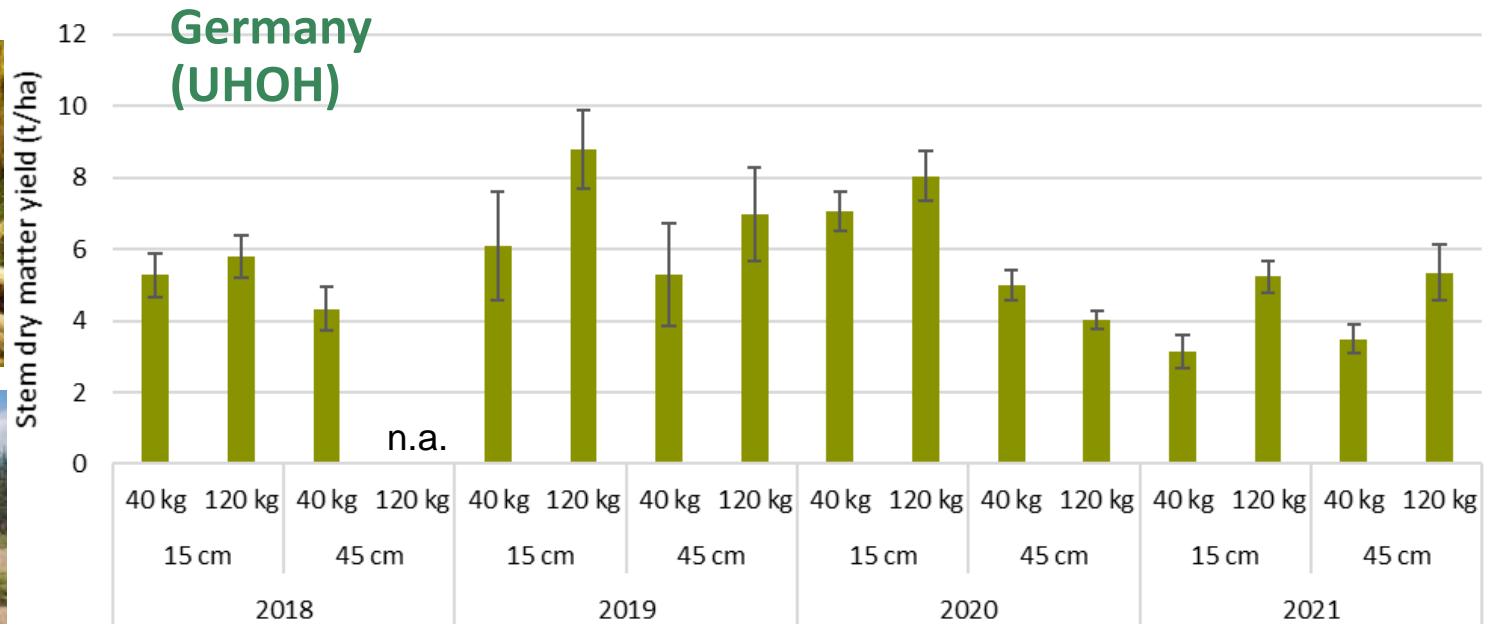
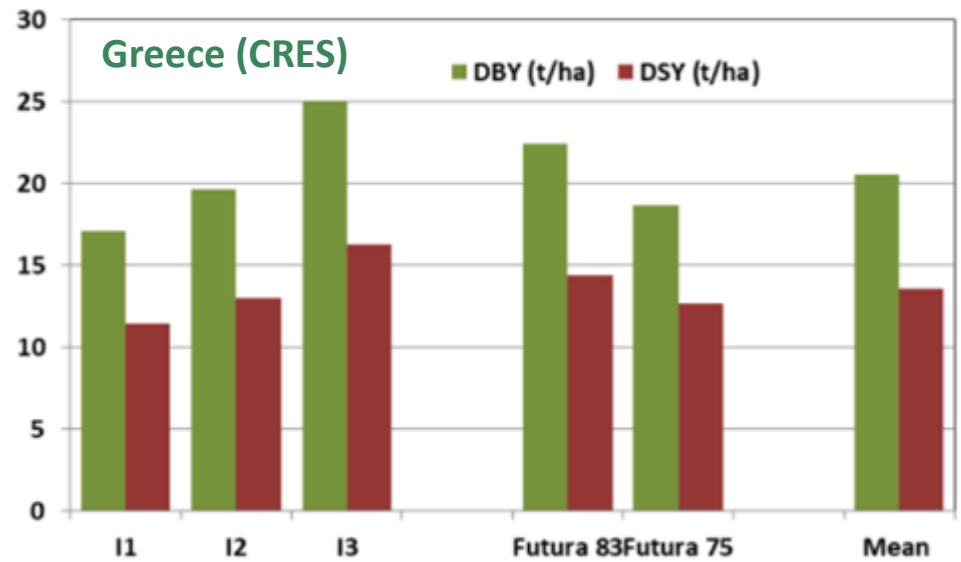
- Short growing cycle (90 to 120 days)
- It can be grown throughout Europe as winter or spring crop
- It can be grown even on dry areas of Spain
- It is an ideal cover catch crop that makes the double cropping a feasible option
- Using the existing machinery and seeds are available

- *A large number of EU projects are working on camelina like MAGIC, BIO4B, UNTWIST, 4CEMED, CARINA, etc.*

Hemp a fibre multipurpose crop; it was studied by the majority of the MAGIC partners for a period of 4 years with very promising results.

Moreover, hemp can be exploited on contaminated lands by heavy metals and several fields had been established in GOLD project with very promising results (www.gold-h2020.eu).

Hemp yields in Greece (CRES) and in Germany (UHOH) by MAGIC project



Case studies in BIKE

Value chain type 1

- Castor bean cultivation in unused, abandoned or severely degraded land for HVO (vegetative oil extraction and hydrogenation)
- Italy, Tunisia and Greece
- ENI biorefinery



- Perennial crops in unused, abandoned or severely degraded land for bioethanol production (lignocellulosic biomass conversion on sugars)
- Italy, Greece, UK
- Lignocellulosic EtOH



Value chain type 2

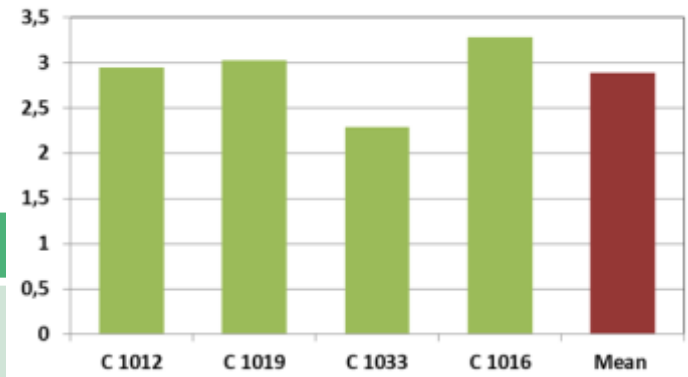
- Brassica carinata in rotation with conversion crops for HVO (vegetative oil extraction and hydrogenation).
- Italy, Greece, Uruguay.
- UPM Carinata biofuels model



- BDR model in rotation with agricultural crops for biogas to liquid conversion for F.T. diesel or MeOH production.
- Italy (two sites), Greece
- Biogas Done right model.



The case of Castor bean (abandoned, unused, severely degraded)



Case study	Greece (three sites)
Where and how	<ul style="list-style-type: none"> ✦ Volos (central Greece); 2021 & 2022 ✦ In an abandoned agricultural site
Cultural practices	<ul style="list-style-type: none"> ✦ No till ✦ The hybrid C1012 imported from KAIIMA Brazil was used. ✦ Basic and top fertilization was applied ✦ No insects/diseases detected.
Harvesting	<ul style="list-style-type: none"> ✦ Harvesting: two machines were tested; for sunflower and cereals ; the one for sunflower performed well. Ten days before harvesting the plants were spayed with herbicides to get dry and schedule the final harvest
Yields and uses	<ul style="list-style-type: none"> ✦ Mean seed yields: 2 to 2.5 t/ha ✦ Oil content: 40-45% (



Castor bean (Volos); mid July 2021



No tillage sowing

It was repeated in 2022

In BECOOL project five innovative rotation systems have been compared with the conventional rotation scheme that is corn-fallow-wheat



BECOOL
Brazil-EU Cooperation for Development
of Advanced Lignocellulosic Biofuels



The lowest biomass yields (t/ha) had been recorded by C rotation scheme where maize is being rotated with corn.



BECool

Brazil-EU Cooperation for Development
of Advanced Lignocellulosic Biofuels



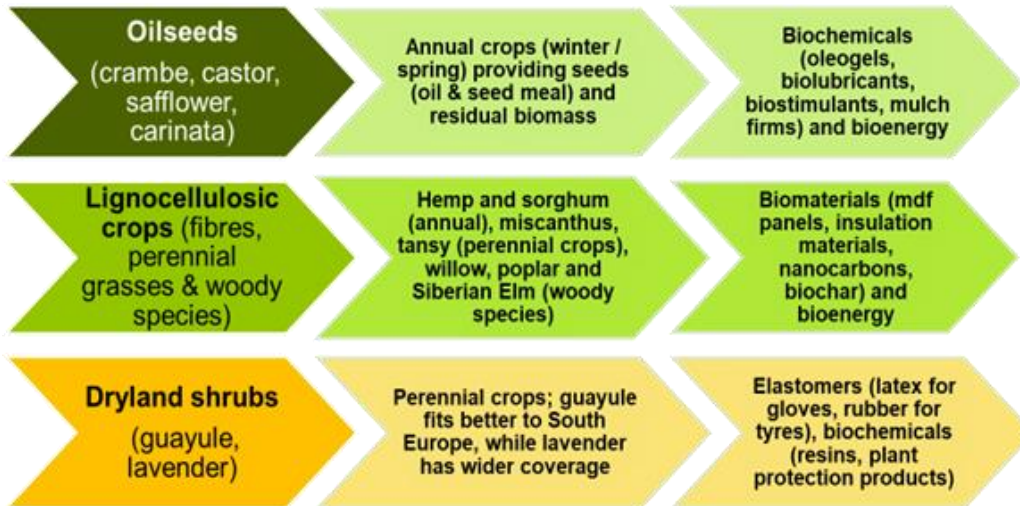
*Durum wheat, June
2021 (5.5 t/ha seeds
and 8.0 t/ha straw)*



*Sunn hemp, September
2021; 12 t/ha dry biomass*



Non-edible crops for MIDAS



Oilseeds (crambe, carinata, castor)



Dryland shrubs (Guayule)



Lignocellulosic (woody crops, perennial grasses, hemp, etc.)



Midas

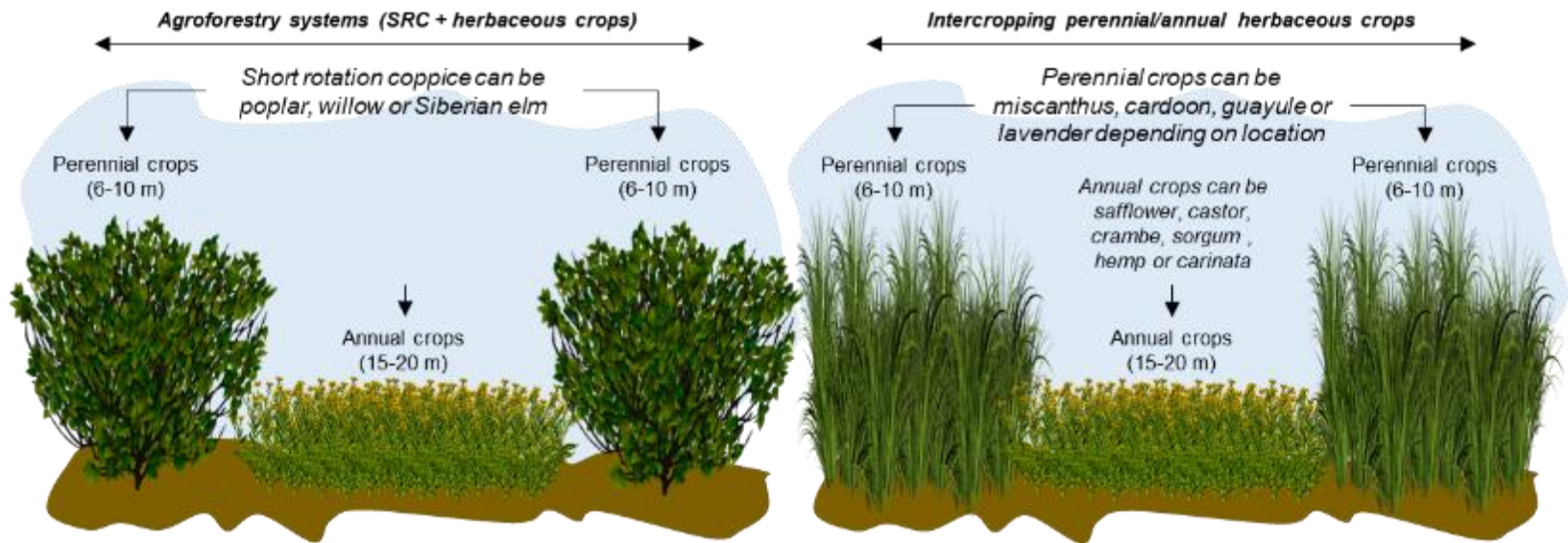
MARGINAL LANDS. INDUSTRIAL CROPS AND INNOVATIVE BIO-BASED VALUE CHAIN

Innovative Cropping Systems (intercropping & agroforestry)



Midas

MARGINAL LANDS, INDUSTRIAL CROPS AND INNOVATIVE BIO-BASED VALUE CHAIN



Nine case studies will be developed where the Midas innovative cropping systems will be evaluated; Each case study will be connected with a Regional Advisory Board consisting mainly from practitioners.



Thank you!

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