



Perennial crops for bioethanol

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Efi ALEXOPOULOU



**KAPÉ
CRES** | CENTRE FOR RENEWABLE
ENERGY SOURCES AND SAVING



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BIKE aims to:

analyze and showcase the good practices of selected case studies in BIKE

promote their replicability at EU level and

provide an overview of the lessons learnt for further market uptake of low ILUC risk biofuels.

Two value chain types matching the definition for additionality:

- ✦ cultivation in **unused, abandoned** or **severely degraded land** &
- ✦ **productivity increases** from improved agricultural practices



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

- ✦ Castor 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)

Task 6.1: Good practice case studies



The following **case studies** are being developed:

- ➔ **CS1: Castor oil for HVO** (unused, abandoned or severely degraded lands) located in Italy, Kenya and Greece; led by **ENI**
- ➔ **CS2: Perennial lignocellulosic crops for advanced biofuels** (unused, abandoned or severely degraded lands) located in Italy, Greece and UK; led by **REC**
- ➔ **CS3: Brassica carinata for HVO** (as cover crop, in rotation systems with conventional crops) located in Italy, Greece and Uruguay; led by **UPM**
- ➔ **CS4: BRD model for liquid biofuels for road, aviation and maritime** from decentralised and distributed biomethane production through centralised FT or synthesis (in rotation systems with conventional crops) located in Italy, Greece and UK; led by **CIB**



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

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Value Chain Type 2: productivity increases from improved agricultural practices

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The **good practice reports** will include:

detailed description of each case study, details of the feedstock (cultivation strategy, achieved yields and quality of the produced biomass), TRL level, conversion technologies, market needs, gaps and needs for future market uptake, sustainability framework and policy issues.

Case studies for perennial grasses on unused, abandoned, seriously degraded lands

- ➔ **Miscanthus:** Italy (Lombardy), UK and Greece (central Greece); **3 case studies**
- ➔ **Switchgrass:** Greece (Aliartos) **1 case study**



2nd year

**View of switchgrass field
in an abandoned land in
central Greece**



15th year

**View of miscanthus field
in an abandoned land in
central Greece**



The case of switchgrass (abandoned, unused, severely degraded)

Case study	CRES (Greece)
Where and how	<ul style="list-style-type: none">✦ Aliartos (central Greece); The field was established in 1998 and is still ongoing. The total area was 0.5 ha
Cultural practices	<ul style="list-style-type: none">✦ Soil preparation (harrowing, and plowing). A fine seedbed was necessary due to small seed.✦ A chemical weed control was done before sowing.✦ The distances between the rows were 15 cm.✦ Basic (11-15-15) before sowing and then every 5 years before regrowth.✦ Top nitrogen fertilization of 60 kg N/ha every spring (30-40 days from regrowth)✦ No insects/diseases detected.✦ A piping system was used for irrigation.
Harvesting	<ul style="list-style-type: none">✦ Harvesting: manually several times when the racemes were ready
Yields and uses	<ul style="list-style-type: none">✦ Mean dry biomass yields 12 t/ha (of 20 years); top yields were recorded in year 2 & 3; the dry biomass had 40% leaves; the ash content of the harvested material was 4-5%. The calorific value was 4560 kcal/kg (NCV) 4260 kcal/kg (GCV) .

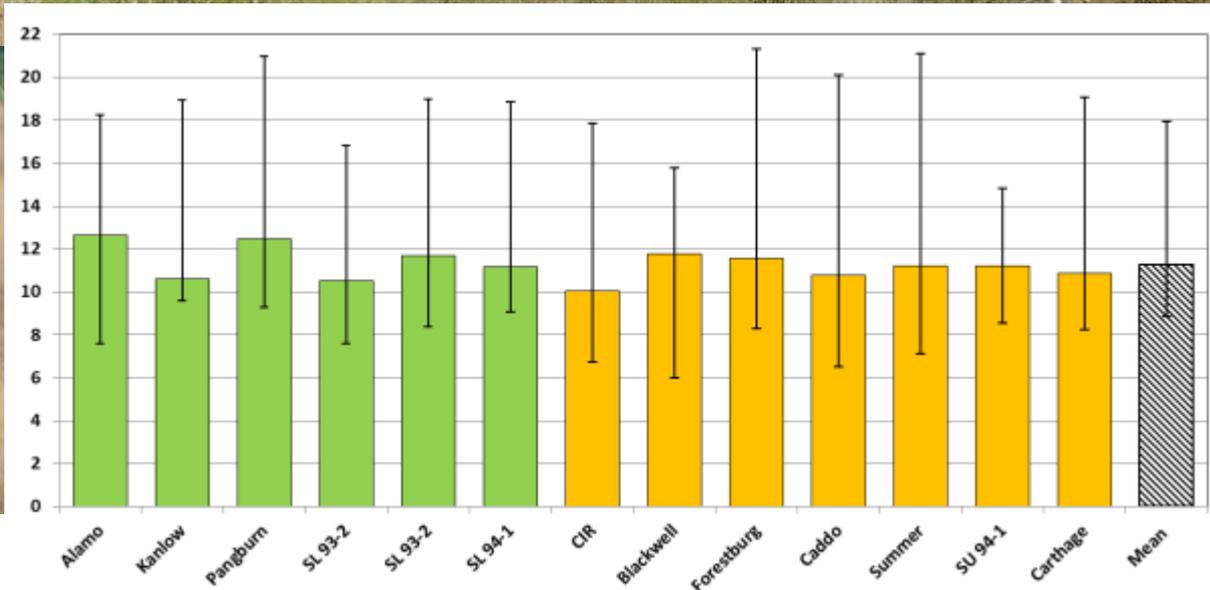


Switchgrass in the beginning of summer



View of switchgrass field in an abandoned land in central Greece

Switchgrass at the maturity phase



Dry yields (t/ha), mean of 20 years

The case of miscanthus (unused agricultural land)

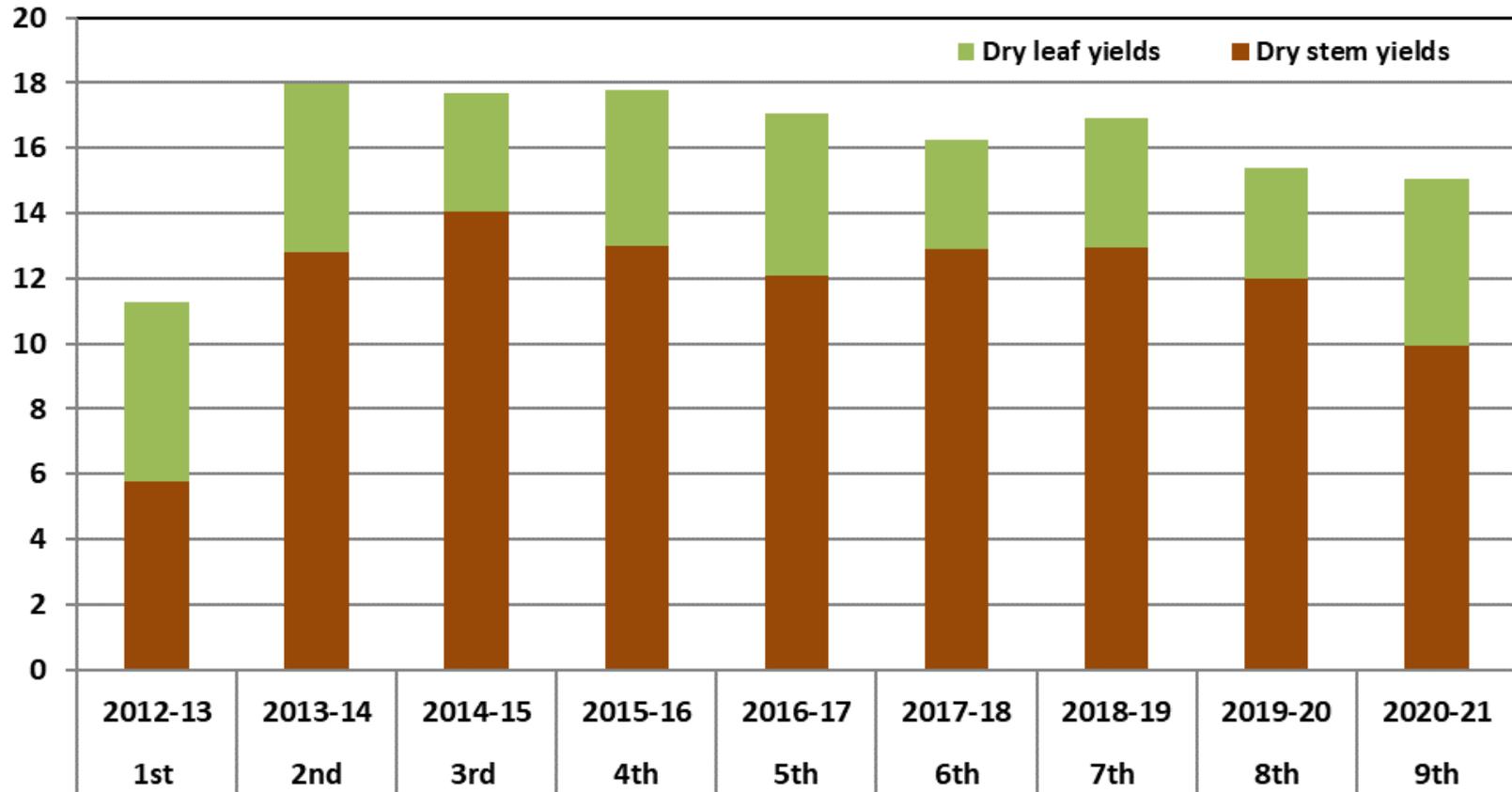
Case study	CRES (Greece)
Where and how	✦ Aliartos (central Greece); The field was established in 2012 and is still ongoing. The total area was 0.4 ha
Cultural practices	<ul style="list-style-type: none">✦ Soil preparation (harrowing, and plowing). The plantation was established by rhizomes.✦ A chemical weed control was done before sowing.✦ The distances between the rows were 70 cm. Two different plant densities have been applied; 50 and 100 cm within the rows✦ Basic (11-15-15) before sowing and then every 5 years before regrowth.✦ Top nitrogen fertilization of 60 kg N/ha every spring (30-40 days from regrowth)✦ No insects/diseases detected.✦ A piping system was used for irrigation.
Harvesting	✦ Harvesting: manually at the end of each growing period; after a killing frost
Yields and uses	✦ Mean dry biomass yields ... t/ha (of 20 years); top yields were recorded in year 2 & 3; the dry biomass had 20-30% leaves; the ash content of the harvested material was 2-3 %.



Miscanthus field



Mean yields of 16.5 t/ha as mean of 9 years



The leaf material is 27% of the total dry biomass



Miscanthus (*Miscanthus x giganteus*) Poaceae family



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.



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.

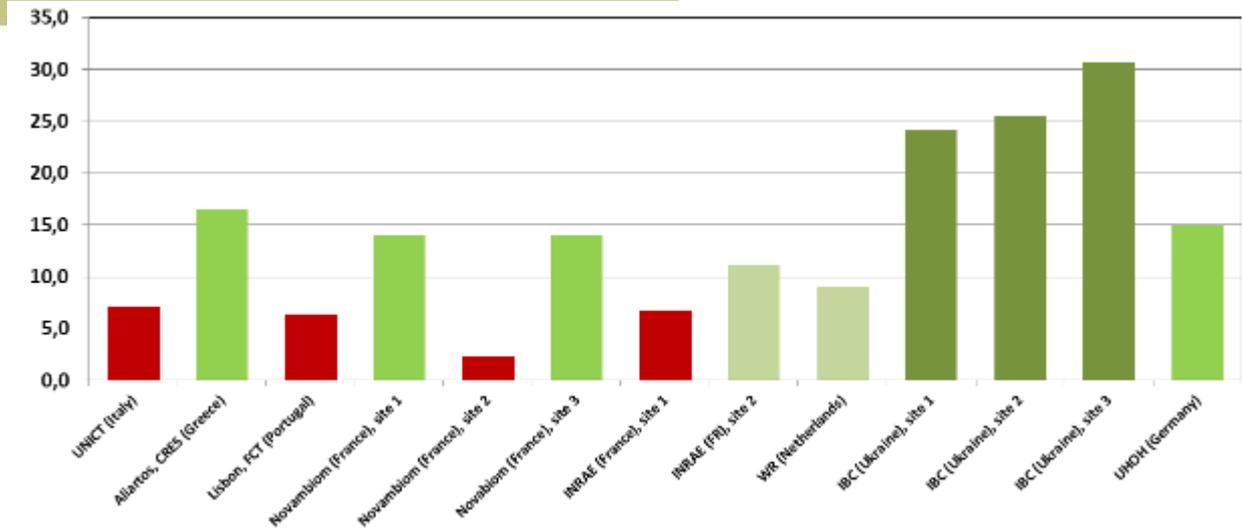


In MAGIC several field trials carried out throughout Europe



The long-term field trials for miscanthus have been established in Greece, Italy, Portugal, France, Netherlands, Germany with lifetime 2 to 14 years. New field trials have been also established in the view of MAGIC project in France and Germany.

Dry yields (t/ha) of miscanthus in several marginal lands in Europe for MAGIC project



Field Days in Greece



2 field days had been organized in Greece; the 1st took place in July 2021 in Xanthi, while the 2nd in Volos in September 2022; both days had been focused on castor bean.



*29/9/22, Open Lab
on lignocellulosic
crops*



Thank you!

@BIKEPROJECT

Bike-biofuels.eu

info@bike-biofuels.eu



(Coordinator)



etaflorence
renewable
energies

exergia
CLIMATE CHANGE CONSULTANTS



Imperial College
London



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