



**EUBCE 2024**

32nd European Biomass Conference & Exhibition

# **EXPERT WORKSHOP ENVIRONMENTAL SUSTAINABILITY OF CROPS FOR BIO-BASED INDUSTRIES IN EUROPE**

Wednesday 26 June 2024 - 12.00-15.45 Room Samena

Philipp Grundmann

Leibniz-Institute for Agricultural Engineering and Bioeconomy (ATB)

Question 1: Select the 1-2 types of primary crops used in industrial biorefineries producing bio-based chemicals, materials, products that you will present: what are the volumes or areas of such crop(s) in the EU and what are the uses (e.g., final products, intermediate chemicals, etc.)?

Virginia mallow (*Sida hermaphrodita*) and Willow (*Salix spp.*):

- High biomass yields, with annual harvests for Virginia mallow and biennial to triennial harvests for willow.
- The crops can be integrated into agroforestry systems and are suitable for cultivation on marginal lands.

Geographical distribution, areas cultivated and volumes:

- Willow is grown in the EU as SRC (Short Rotation Coppice) system on approximately 19,300 ha (in 2022).
  - The largest area under cultivation is in Sweden (approx. 8,500 ha) and Poland (approx. 7,800 ha).
  - The area of Willow under cultivation in Scandinavia has decreased significantly in the past years, e.g. in Sweden from 12,000 ha (in 2012) to 4,500 ha (in 2022).
- Virginia mallow is a new crop in Europe. The original area of occurrence is the USA and Canada.
- In Hungary, around 4,000 tons of Virginia mallow biomass are produced annually.



Key applications and products:

- Willow is used primarily for energy production, but can potentially also be used in LCF-biorefinery processes.
- Virginia mallow is cultivated in Hungary mainly as substrate for other crops and mushrooms.
- Post-use substrate serves multiple purposes, including biogas production, biofertilizer and protein-rich feed additive.

Question 1: Select the 1-2 types of primary crops used in industrial biorefineries producing bio-based chemicals, materials, products that you will present: what are the volumes or areas of such crop(s) in the EU and what are the uses (e.g., final products, intermediate chemicals, etc.)?

Primary crops and biomass used in industrial processes:

- Paludiculture involves cultivation wetland plants like Reed Canary Grass (RCG), which thrive in waterlogged conditions.
- Cultivation often takes place in connection with the restoration of fenlands and marginal grassland areas.
- Cultivation is being demonstrated at industrial scale including Reed (*Phragmites australis*), Cattail (*Typha spec.*), Sedges (*Carex spec.*) and other grass species.

Geographical distribution, areas cultivated and volumes:

- Reed Canary Grass is natural in Europe, Asia, northern Africa and North America.
- Total cultivation area in Germany in 2021 amounted to approx. 6,500 ha.
- In view of the ongoing restoration efforts, the potential area for these plants is considerable.

Key applications and products:

- Reed Canary Grass is used as fodder grass in North America and Northern Europe.
- RCG serves to produce pellets for various applications: panels, animal bedding, biofertilizer (biochar), and fuel pellets.
- Fibres and protein extraction from grass are being demonstrated for industrial-scale paper production.
- Long fibres are used for green pellet substrates or growing media. Medium-short fibres are processed for animal bedding, with subsequent nutrient recovery in horticulture. Very short fibres and dust are used as fuel pellets.



## Question 2: What are the main relevant environmental impacts related to the cultivation of the selected crops?

### Key environmental impacts:

- Willow and Virginia mallow support circular bioeconomy by maximizing biomass resource use.
- Herbaceous and woody crops improve water retention.
- Increase soil organic carbon, mitigating desertification and land abandonment.
- Supports biodiversity by providing habitats even for protected species, including plants, birds, and pollinators.
- Can be cultivated on areas that are not suitable for food production.
- The potential of Virginia mallow for invasiveness is discussed but not clear.
- Willow can have some negative impacts on destruction of water drainage systems.

### Environmental impacts related to specific application types:

- Efficient recycling and valorization of spent mushroom substrate (SMS) reduces environmental problems and disposal costs, enhancing sustainability in the mushroom industry.
- Cascade use of biomass for mushroom cultivation, biogas production, and biofertilizer application minimizes external fertilizer use, reducing GHG emissions from production and transport.
- Renewable energy from biogas further reduces GHG emissions by replacing fossil fuels in CHP (combined heat and power) systems for electricity and heat.

## Question 2: What are the main relevant environmental impacts related to the cultivation of the selected crops?

### Key environmental impacts:

- Paludiculture and grass as feedstock improve resource utilization by using biomass that would otherwise rot on grassland and lead to emissions in composting plants.
- According to the current state of the art, neither fertilization nor the use of herbicides or pesticides is required.
- Paludiculture reduces GHG emissions by restoring mire-like conditions and preventing peat degradation.
- Replacing annual crops with permanent grassland contributes to carbon sequestration in the soil and to less nitrate leaching.
- Enhances biodiversity by creating new habitats for rare and endangered species (e.g. birds), particularly in large-scale fenland nature reserves.
- Supports protection targets for nature reserves defined by the presence of grassland bird species.
- Utilizes wetland areas that do not compete with food production, ensuring sustainable land management.
- Biomass from wetland plants is efficiently used for various products, minimizing waste and enhancing resource efficiency.
- The production process is nearly climate-neutral, with products that are biodegradable and part of the carbon cycle.

## Question 3 - What are the main 'best available practices/technologies' to grow such agricultural crops minimizing the impacts and maximizing the benefits for the environment?

### Key good practices

- Implementation of agroforestry systems that combine herbaceous and woody plants, improving soil health, water retention, and resilience to environmental stresses.
- Introducing Willow and Virginia mallow in agroforestry systems enhances agrobiodiversity and supports essential ecological processes, ensuring sustainable agricultural production.
- Different harvest times for herbaceous and woody crops maximize landscape heterogeneity, providing continuous biomass supply and enhancing biodiversity compared to monocultural systems.
- Introducing new land use types at a landscape scale to diversify biomass sources and enhance ecosystem resilience.
- Potential for restoration of marginal lands not competing with food production.
- Utilizing biomass in a cascading system in LCF-biorefineries can provide additional value as cultivation substrate, biofertilizer, and biogas, maximizing resource efficiency and minimizing waste.
- Ensuring that products are biodegradable and can be returned to the soil, supporting the carbon cycle and sustainability goals.

Question 3 - What are the main 'best available practices/technologies' to grow such agricultural crops minimizing the impacts and maximizing the benefits for the environment?

Key good practices

- Introducing new land use types at a landscape scale, such as rewetted fenlands, to diversify biomass sources and enhance ecosystem resilience.
- Practice late harvest to protect wildlife and biodiversity.
- Utilize harvested biomass from rewetted fenlands to produce various products, reducing GHG emissions and preventing peat degradation.
- Ensure all products are biodegradable and can be returned to the soil, supporting the carbon cycle and sustainability goals.
- Engage farmers, local companies, and stakeholders from politics, water management, and environmental protection to leverage local expertise and ensure a comprehensive approach to biomass utilization.