Upscaling ***Sphagnum*** founder material propagation and highly productive provenances - the joint **paludiculture** research project ‚MOOSstart'

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PALUDI CULTURE
MOOSstart

Background: To achieve the goal of zero CO_2 emissions by 2050, both the drainage-based use of peatlands and the use of peat in growing media are no longer appropriate. *Sphagnum* moss cultivation in paludiculture offers an unique opportunity to produce high quality renewable raw materials for horticultural substrates on rewetted, degraded peatlands, with benefits for climate and biodiversity.

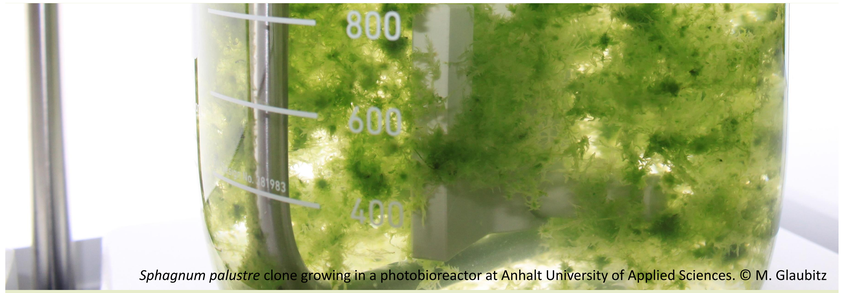

Sphagnum indivíduales in a climate chamber experiment at University of Greifswald. © M. Kohl

Moss productivity

For the profitability of *Sphagnum* paludiculture we investigate the increase of moss productivity at two different levels:

a) molecular level (using transcriptome-based process analysis and phytohormones) to increase the efficiency of photobioreactors.
b) provenance/species level by identifying highly productive provenances (hummock, lawn, hollow) in mesocosm trails, labelling via barcoding, validating selection results in field trials and investigating plasticity within clones depending on different site factors.

We focus on 12 *Sphagnum* species (wild provenances from hummocks, lawns and hollows of European bogs and cultivated clones of *S. austinii, S. centrale, S. denticulatum, S. fallax, S. fimbriatum, S. fuscum, S. divinum/S. medium, S. palustre, S. papillosum, S. riparium, S. rubellum,* and *S. squarrosum*).



Sphagnum palustre clone growing in a photobioreactor at Anhalt University of Applied Sciences. © M. Glaubitz

Mass propagation

In the previous project MOOSzucht, vegetative starting material was successfully propagated axenically in a photobioreactor*. This process will now be further developed and scaled up. The development of a low-cost photobioreactor for decentralised and outdoor use includes:

a) testing different reactor concepts and their optimisation to establish a production process,
b) optimising nutrient and light supply,
c) developing a harvesting method,
d) practical test by a producer.

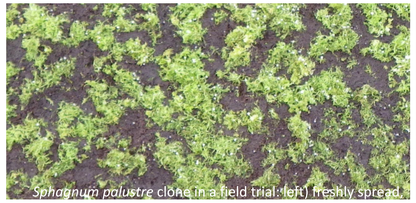

Sphagnum centrale, axenically produced in a photobioreactor at Freiburg University. © M. Heck

* further reading:
Heck et al. (2021) Axenic in vitro cultivation of 19 peat moss (*Sphagnum* L.) species as a resource for basic biology, biotechnology, and paludiculture. New Phytologist.
Heck et al. (2021) Medium optimization for biomass production of 3 peat moss (*Sphagnum* L.) species using fractional factorial design and response surface methodology. Bioresource Technology Reports.


Sphagnum paludiculture pilot trial in the peatland ‚Hankhauser Moor' in Lower Saxony, Germany. © T. Dahms

Field application

The morphology of founder material produced in a photobioreactor differs from moss grown under natural conditions: bioreactor moss looks like green snowflakes and has a very high density of innovations (new shoots). Therefore, the mechanical application technique must be adapted. Production in the photobioreactor can be carried out all year round. To determine the optimal 'seeding' period, the moss material was applied at seven times between the beginning of March and end of November.


Sphagnum palustre clone in a field trial: left) freshly spread, and right) 12 months later. © Greifswald University

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