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Report of the BUFFER+ Partner Meeting in Emden 2024 including Peer Review results

Introduction

The extraction and use of peat results in massive CO_2 emissions. Reducing the amount of peat in growing media would therefore be an effective climate protection measure. The third BUFFER+ partner meeting took place from October 8 to 10, 2024 in the Weser-Ems region focussing on the use of peat and peat substitutes in horticulture.

Peat has been mined in the far north-west of Germany, close to the Netherlands, for centuries. This has been done on a large scale since the 16th century, when the peat was mainly used as fuel peat in private households and brickworks. In the middle of the 20th century, a significant peat industry developed, which now covers the entire value chain from the extraction of peat to the production of horticultural substrates and the use of peat-containing substrates in plant cultivation.

Currently, the Weser-Ems region is still a center of peat extraction and use in Europe. However, this will soon change because the German government has adopted a peat reduction strategy to protect peatlands. Plant soils for hobby gardeners are to be peat-free by 2026, and the aim is for professional growing media to be peat-free by 2030. Many peat extraction licenses will expire in the coming years, which means that both peat extraction and use could come to a standstill in Germany in the foreseeable future. This is already leading to a major upheaval in regionally important industries: more and more peat factories, substrate manufacturers and plant producers must decide whether and with which peat substitutes they will work in the future.

The third BUFFER+ meeting dealt intensively with peat extraction, peat utilization and peat substitutes for growing media. The excursion to regional companies that work with peat and peat substitutes showed the partners how important these topics are for the BUFFER+ peatland and climate protection project.

Peat replacement in a tree nursery

The first stop on the excursion was the tree nursery Hinrichs Pflanzen. The nursery produces flowering shrubs, ornamental shrubs, various trees and hedge plants on over 40 hectares. During a guided tour, company owner Jan Hinrichs said that anticipating a future peat ban he wanted to be proactive working already now with peat-free and peat-reduced substrates. He explained that half of the

container plants grow in 50% peat and the other half in a completely peat-free substrate. In comparison, horticultural substrates usually contain 70-90% peat.

Coco coir and wood fibres are mainly used as peat substitutes. At €75-90 per cubic meter, coir pith is around twice as expensive as peat, but according to Mr Hinrichs, this does not have a major impact on the sales price and margin. The comparatively lower water capacity of peat substitutes is also not a problem because the nursery has modern irrigation systems. Mr. Hinrichs even has the impression that this property could be responsible for the better root growth observed in the plants.

The peat-free or peat-reduced label has not yet played a role in the marketing of the plants because acceptance among major customers and consumers is still unclear. Another problem is that the nursery buys young plants that have been grown in substrates containing peat. As a result, peat can be present in small quantities, even though Hinrichs Pflanzen has not added it to the substrate mix. The BUFFER+ partners proposed to introduce a peat score similar to the well-known nutrient score for food: Class A would indicate that the plants were produced without the use of peat, while the least environmentally friendly class E would indicate that high levels of peat (e.g. >70% of the total amount of substrate) were used during the plant's cultivation life cycle.

Use of peat substitutes in the nursery Hinrichs Pflanzen. Jan Hinrichs demonstrated that root development is good in a substrate containing mainly coco coir (left picture). Mario Reil explained which peat substitutes are being tested in the ToSBa project (right).

Hinrichs Pflanzen is partner in the ToSBa project. The model and demonstration project aims to show how high-quality woody plants can be produced in containers using strongly peat-reduced substrates. Mario Reil from the Lead partner Chamber of Agriculture of Lower Saxony presented various additives for substrates, including processed wood, bark products and coconut products as well as *Sphagnum* moss from paludiculture. The most promising is coco coir from South or Southeast Asia, where it is a waste product of coconut production. Despite long transportation routes, coco coir has a better CO_2 balance than peat. Mr. Reil and Mr. Hinrichs agree that it is possible to partially or even completely dispense with peat in professional plant cultivation, even if it may be necessary to change operating procedures. However, around 5 million cubic meters of peat are still used in Germany every year. Against this background, the availability of peat substitutes in sufficient quantities is potentially a limiting factor.

The BUFFER+ partners learned that there is a wealth of knowledge about substrates in the region and that peat substitutes are being developed and tested in various initiatives. However, there is still a lack of consumer knowledge. For example, light-coloured wood fibres must be dyed with charcoal because consumers expect potting soils to be dark brown, clearly indicating an information gap about the nature and properties of available peat substitutes. In this context, consumers should also be made aware of the importance of peat substitutes in potting soils for climate and peatland protection.

Large-scale peat extraction and peatland renaturation

The BUFFER+ partners were able to see the dimensions of industrial peat extraction in the Saterländer Westermoor. The raised bog covers a total of 5000 ha, and the peat factory Moorkultur Ramsloh Werner Koch GmbH & Co. KG is engaged in peat extraction on land previously used for agriculture. Two of the company's employees, Silke Kumar and Ludger Thedering, explained how peat harvesting works during a ride on the “Seelter Foonkieker” peat train: First, peat is extracted using the milled peat method. The peat is then spread over the surrounding area to ensure that it freezes evenly. During this maturing process, the peat structure breaks up, which improves the water and air capacity. In this way, around 250,000 m^3 of frozen black peat was extracted from a 400-hectare area in 2024. This corresponds to almost 10% of the total amount of peat extracted in Germany.

Peat extraction and rewetting in the Saterländer Westermoor. Peat was spread on the extraction site to mature (left). Typical peatland species such as Sphagnum *moss grow in the re-wetted areas of the Westermoor (right).*

Extraction ends when the peat layer reaches a residual thickness of 0.5 m. Currently, 4000 ha of the Westermoor are in the process of renaturation. The only legal requirement is rewetting. This involves closing drainage channels and building dams to dam up the water. The planting of typical moorland vegetation is not mandatory. The maintenance of the biotope by removing the unwanted birch growth and biotope or species monitoring are also not prescribed by law but are carried out voluntarily by the peat factory. Ms. Kumar reported that the Saterländer Westermoor is slowly regenerating, which can be seen, for example, in the natural spread of peat mosses. The BUFFER+ partners wondered why there were no legal requirements for the implementation, maintenance and monitoring of peatland restoration after peat extraction.

Use of peat and peat substitutes for horticultural substrates

The raw peat from the Westermoor is transported on a peat train to the Moorkultur Ramsloh peat factory, which belongs to Floragard Vertriebs-GmbH. There it is processed by grinding and sieving and is subsequently either delivered as a raw material or processed into growing media on site.

The peat factory also produces substrate additives, some of which are used as peat substitutes: For example, there is a composting plant and facilities in which wood fibres are produced from wood chips using a thermal-mechanical process. Peat substitutes including wood fibres are often low in nitrogen (N) but high in carbon (C). When materials with a high C/N ratio are added to a substrate mix, microbes rapidly metabolise the nitrogen, making it unavailable to plants. To prevent this so-called nitrogen immobilization the wood fibres are “stabilized” by adding a nitrogen fertilizer. Nevertheless, even stabilized wood fibres cannot completely replace peat, but make up a maximum of 30% of a growing medium.

Coco coir and, to a limited extent, wood fibres, green compost, composted bark, and miscanthus grasses are promising peat substitutes, but it is questionable whether these materials will be available in sufficient quantities and reliable quality in the future. Ms. Kumar develops and researches new additives for growing media. According to her a major advantage of peat is that it can be transported from the extraction site to the substrate manufacturer on demand throughout the year and does not need to be stored. Other materials either need to be stored or produced and transported in time, requiring complicated and expensive logistics.

Production of substrates at Torfwerk Moorkultur Ramsloh. Peat from the Saterländer Westermoor and from the Baltic States is processed (left). Ms Kumar explained that wood fibres are prepared in a thermo-mechanical process and "stabilized" by adding nitrogen to prevent N immobilization by soil microbes (right).

Another aspect emphasised by the BUFFER+ partners is that peat substitutes must be sustainable. For example, coco coir is a by-product of coconut production. It should be avoided that coconut plantations are established in place of primeval forests just to produce the much sought-after coco coir. Similarly, the production of peat substitutes in Germany should be sustainable. Ideally, the production should be diversified and established regionally to avoid environmental damage and long transport routes. In any case, the overall CO_2 balance of peat substitutes must be significantly better than that of peat. For these and other reasons, Ms Kumar is convinced that peat will be difficult to replace in professional horticulture - especially in the production of young plants and champions.

Efficient horticulture is essential to supply the world's growing population with vegetables and ornamental plants, and for the foreseeable future at least, peat will continue to be a major component of substrates. In fact, according to current projections, the global demand for peat is steadily increasing. In particular, horticulture in some Asian and Middle Eastern countries is moving from soil-based to pot-based systems, which require large amounts of peat. Companies from these regions are already buying peat, peatland and peat extraction licences in Europe, mainly in the Baltic States.

Reducing the use of peat in Europe may therefore not be enough to protect peatlands. The German peatland protection strategy and the peat reduction strategy have so far been based on voluntary action. Internationally, only a few countries have launched similar initiatives to reduce peat use. For example, in 2022, the Netherlands brought to life the “Covenant on the Environmental Impact of Potting Soil and Substrates” with the aim of lowering the use of peat in horticulture and hobby gardening. In the long term, a common European policy and legislation is needed to protect peatlands by controlling or even banning peat extraction. At the same time, the substrate industry needs to be supported in the transition from peat-based to peat-reduced and peat-free substrates.

Because both the legal situation and the future development of the market for growing media are unclear, Torfwerk Moorkultur Ramsloh is pursuing a two-pronged strategy: on the one hand, the peat factory is investing in the development and research of peat substitutes and, on the other, it is

importing peat from Baltic states in order to continue to meet national and international customer demand despite the decline in peat extraction in Germany.

Peat moss production in paludiculture

Ms. Kumar has been working intensively with *Sphagnum* mosses for 10 years. The MOOSland project (2023-2032, https://www.moorwissen.de/moosland.html) is currently conducting trials on 20 hectares of peat moss production in the Hankhauser Moor. Peat mosses are particularly suitable as a peat substitute because, like peat, they have an acidic pH and a high water and air capacity. The BUFFER+ partners were able to marvel at a well-filled silo with *Sphagnum* at the Ramsloh peat factory. This example shows that peat moss paludiculture is scalable, even if the harvest volumes are not yet large enough to replace peat on a significant scale.

Sphagnum *as a peat substitute. Torfwerk Moorkultur Ramsloh uses* Sphagnum *peat moss grown in paludiculture for peat-free substrates.*

In Germany there are around 1.8 million hectares of drained peatlands, some of which could be rewetted. The government has launched several initiatives, including the National Peatland Strategy (2022), the National Water Strategy (2023) and a programme for natural climate buffers (2023). These initiatives are useful to inform farmers and other stakeholders about paludiculture and to facilitate the funding for trial and demonstration sites. However, the Buffer+ partners noted that farmers will only adopt paludiculture if legal, political and economic constraints are overcome.

Currently, *Sphagnum* is not considered a crop under the Common Agricultural Policy (CAP) because it cannot be harvested every year. Cultivation of this plant would therefore mean that the agricultural status of the land would be lost. Most drained peatlands are grasslands. German law does not allow grassland to be converted into arable land, making it even more difficult to establish new areas for paludiculture. Farmers also face economic constraints: The production of *Sphagnum* on drained peatlands requires a low nutrient status, an acidic pH of the soil, and suitable hydrological conditions. Removing the nutrient-rich topsoil and adjusting the water availability for rewetting is costly. In addition, *Sphagnum* grows slowly and harvesting in wet conditions requires expensive specialist equipment. For these reasons farmers need large areas and high prices to make paludiculture profitable. To reduce the economic risks, farmers practicing paludiculture should have access to agricultural subsidies.

Stakeholder involvement in peatland protection, restoration, and sustainable use

Peatland stakeholders with economic interests include landowners, farmers and various companies. In particular, farmers, substrate producers, and other companies using paludicultural products are important actors in the sustainable use of peatlands. Peat companies are legally responsible for

rewetting peatlands after peat extraction, while government and non-governmental organisations (NGOs) are key players in peatland protection and restoration.

Research institutions, farmers organisations such as chambers of agriculture, and NGOs are involved in research, development, and knowledge transfer. For example, agricultural cooperatives can assist farmers in adopting sustainable practices by providing resources and training. The activities of these actors are often short-term because they depend on project funding. Ms Kumar mentioned that the peat restoration in the Saterländer Westermoor had been surveyed by a research group for a short time, but that there was no possibility of long-term or even permanent monitoring by any organisation. For this reason, the peat plant Moorkultur Ramsloh regularly monitors the restoration progress on a voluntary basis.

BUFFER+ partners suggest that while current stakeholders in peatland management and sustainable agriculture are addressing many critical areas, several additional groups could significantly enhance sustainability efforts. NGOs can run grassroots campaigns to provide ongoing monitoring and maintenance of peatland conservation and restoration sites. Financial institutions and investors are vital for funding sustainable projects and creating financial incentives for peatland restoration. Technology companies can develop innovative tools to monitor peatland health and improve peat-free substrate production.

The tourism industry can promote eco-tourism, fostering community engagement and generating revenue for conservation. Media organizations play a key role in raising awareness and educating the public about sustainable practices. Consumers can influence market trends by choosing peat-free products, while climate change advocacy groups can stress the importance of peatlands in carbon sequestration and water buffering and advocate for protective policies.

BUFFER+ activities on peat substitutes for horticultural substrates

At a workshop in the Ökowerk Emden, the partners presented their activities in the different work packages of BUFFER+. AC3A, CAPDL, Applied University Emden-Leer, Bioclear Earth, HTC Innovation GmbH, and Ökowerk Emden focussed on the results of their work with peat substitutes. The promising plant materials tested so far include reed and grass from wet meadows and marshes. They are rich in fiber, available in large quantities and there is hardly any competition for use. HTC Innovation GmbH and CAPDL have successfully established hydrothermal carbonization (HTC), a method with which plant-based raw materials can be “turbo-turfed” in a pressure reactor at high temperatures within a few hours.

Greenhouse experiments and laboratory analyses showed that some of the materials examined had similar properties to peat. However, the raw materials had unfavourable carbon/nitrogen ratios, which led to nitrogen immobilization in substrate mixtures. Composting, ensilaging or the addition of nitrogen could provide a remedy here. After HTC treatment, strong-smelling volatiles were occasionally emitted, which inhibited plant germination. The gaseous molecules were identified as furfural compounds using gas chromatography. The aim is now to use modified reaction conditions to prevent the formation of volatiles.

The BUFFER+ partners' trials revealed some of the difficulties that substrate manufacturers also face when developing new peat substitutes. Identifying and solving such problems is one of the major aims of BUFFER+.

Summary

The example of a tree nursery proved that it is possible and economical to replace peat in professional horticulture. Coco coir and wood fibres were mainly used for this purpose.

The visit to a peat extraction area and a peat factory gave an impression of the large quantities of peat required for substrate production. Correspondingly large quantities of peat substitutes are not yet available.

Compost, wood fibres, miscanthus and other materials can only be added to growing media at a rate of 10-30%. Peat moss from paludiculture is well suited as a peat substitute, but cultivation is costly, and availability is still low. Coco coir is currently the only additive that can completely replace peat, but it must be imported from Asia and is therefore expensive.

There is still a lack of peat substitutes that are of good quality, cheap and available regionally in large quantities. BUFFER+'s work on this topic is therefore important and well invested.