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SPHAGNUM FARMING ON BOG GRASSLAND IN GERMANY – FIRST RESULTS

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SUMMARY

The production of peat moss biomass on an industrial scale is being investigated on a 4 ha bog grassland in Northwest Germany. After sod removal, peat moss (*S. palustre*, *S. papillosum*) was mechanically spread on bare peat and covered with straw. Different cover densities and sizes of peat moss fragments were tested.
After six months the peat mosses had established well and had in parts developed already into a dense *Sphagnum* lawn. Cover and lawn thickness of *S. palustre* surpassed that of *S. papillosum* in particular when spread as entire mosses.
The management of water supply is essential for the successful establishment of peat mosses and their subsequent growth.

KEYWORDS: Establishment, *Sphagnum palustre*, *Sphagnum papillosum*, growing media

INTRODUCTION

Sphagnum biomass may provide a sustainable alternative to slightly decomposed, fossil ‘white’ peat as a raw material for horticultural growing media (Emmel, 2008; Gaudig *et al*., this volume). The prospects of *Sphagnum* farming on rewetted degraded bogs have been and are being studied by the University of Greifswald and various partners (Gaudig *et al*., this volume, www.sphagnumfarming.net).

The cultivation of *Sphagnum* on cut-over bog was tested successfully at our 1200m² large pilot site (Kamermann and Blankenburg, 2008). After seven years average peat moss lawn thickness was 15 cm and *Sphagnum* productivity reached mean values of 3.6 t dry mass ha^{-1} yr^{-1} (Gaudig *et al*., this volume). Also the cultivation of grassland on bog is an unsustainable form of land use (Wichmann et al., this volume). With 145.000 ha of bog grassland (NLWKN 2006), the federal state of Lower Saxony provides the biggest potential for *Sphagnum* farming in Germany. *Sphagnum* growth on bog grassland sods was successfully tested in greenhouse experiments (Gaudig *et al*., 2008) and consequently a field experiment on 4 ha (10 acres) of bog grassland was installed in May 2011.

This paper presents the first results of *Sphagnum* establishment six months after site installation.

MATERIALS AND METHODS

The pilot site was established in Northwest Germany (Lower Saxony) next to Rastede in the Hankhauser Moor (N 53°15.80' E 08°16.05'). This area is strongly degraded after decades of intensive agricultural use with deep drainage, leading to 1 m of peat loss since 1958.
Over 4 ha (10 acres), the upper highly mineralized peat layer (~30 cm) was removed and used for constructing dams for machine works resulting in 10 m wide production stripes bordered by irrigation channels. After site preparation different sized fragments, entire mosses - only *Sphagnum palustre*, with mean sizes of 0.5 x 6.0 cm and fragments with mean sizes of 0.2 x 1.1 cm of *S. palustre* and *S. papillosum* were mechanically spread on the bare peat so that they covered 40-50, 65-75 or 80-90%, altogether 75 m³ per hectare. Peat mosses were subsequently covered with straw (Quinty and Rochefort, 2003). After installation the experimental site was rewetted.

310 randomly selected permanent plots (25 x 25cm) were installed to study peat moss establishment by recording peat moss cover and lawn thickness. The cover of vascular plants could be kept <30% by regular mowing.

Statistical analysis and figures were made with the software R (R Development Core Team 2009). Differences between sites were analysed with the non parametric Kruskal Wallis test and a multiple comparison test after Siegel & Castellan (1988, R package pgirmess, Giraudoux 2010).

RESULTS

After six months peat mosses grew well and in parts a dense *Sphagnum* lawn had already developed. In general, growth of *S. palustre* surpassed that of *S. papillosum* in cover and lawn thickness (Fig. 1 and 2). Especially the areas spread with entire mosses of *S. palustre* showed the highest cover (mean 54%, Fig. 1A) and lawn thickness (mean 2.2 cm) (Fig. 1B).

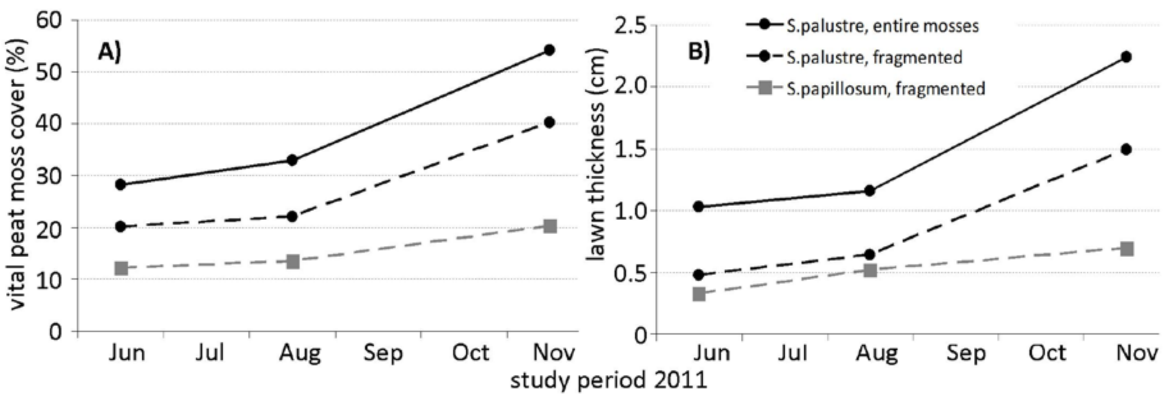

Fig. 1. Development of A) vital peat moss cover and B) lawn thickness (mean) of *S. palustre* and *S. papillosum* and different initial sizes (entire vs. fragmented mosses) over a period of six months after moss spreading (May 2011).

The coverage of fragmented *S. palustre* after six months was similar, independent of initial peat moss cover (Fig. 2). In contrast, fragmented *S. papillosum* covered after six months more where more mosses had been spread (Fig. 2).

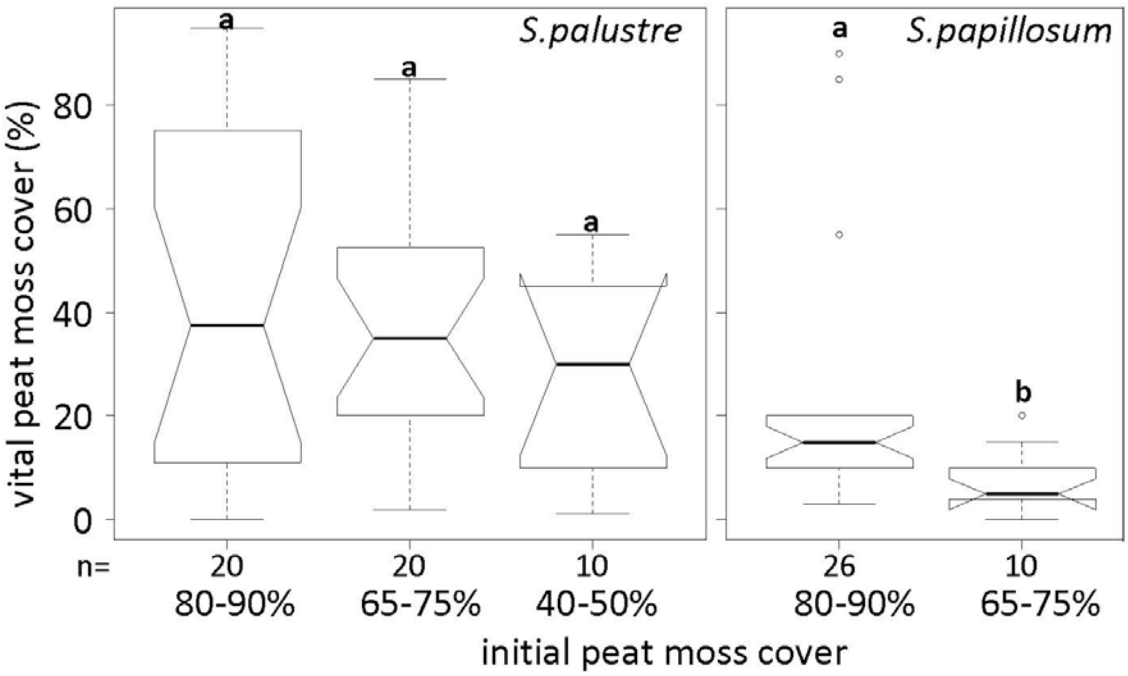

Fig. 2. Vital peat moss cover of fragmented *S. palustre* and *S. papillosum* six months after installation with different initial peat moss cover. Differences were tested within each box separately (Kruskal Wallis and multiple comparison test). Values with different letters differ significantly ($P \leq 0.05$).

DISCUSSION

The establishment of peat mosses on former bog grassland was promising, with *S. palustre* establishing faster than *S. papillosum*. Similar results were obtained in establishment experiments in Georgia (Krebs, 2008). Whereas both species have similar regeneration ability from green moss parts, brown parts of *S. papillosum* regenerate better (Poschlod and Pfadenhauer, 1989). The better growth of *S. palustre* might be ascribed to its wider ecological amplitude with respect to wetness and trophy (cf. Daniels and Eddy, 1985). The irrigation system and high precipitation during the six months (~470 mm, German Weather Service, climate station Rastede) kept the peat almost permanently wet and partly flooded. The upper, strongly mineralised and nutrient enriched peat surface was removed up to the nutrient poor, slightly decomposed peat moss peat, but eutrophic irrigation water was supplied from the adjacent main drainage channel. Whether *S. palustre* was favoured by the very wet conditions (although *S. papillosum* can also tolerate shallow temporary flooding, Rochefort *et al*., 2002) or by nutrient supply from irrigation will be addressed in on-going research.

Entire mosses grew fastest as was reflected in peat moss cover and lawn thickness. This observation is confirmed by greenhouse experiments with fragment sizes of 0.1-0.3 cm compared with 5-10 cm (Gaudig et al., this volume) and research by Landry & Rochefort (2009) indicating that smaller peat moss fragments need a longer establishment phase. Campeau and Rochefort (1996) and Johnson *et al.* (2000) observed faster establishment (peat moss cover after several months) when more peat mosses were spread. Our experiment confirms this observation with respect to *S. papillosum* (Fig. 2A). Also *S. palustre* showed highest cover after spreading large amounts of peat moss (80-90%), but differences were not significant after six months.

CONCLUSIONS

Six months after installation we can conclude, that

- the mechanical installation of 4 ha *Sphagnum* biomass cultivation area was successful
- *Sphagnum* farming on former bog grassland is possible
- *S. palustre* seems to be more suitable for *Sphagnum* farming, because of fast establishment, in particular when entire mosses are used
- further study of the effect of initial peat moss cover, water table and nutrient availability is required
- a high and stable water table can be ensured by a system of controlled irrigation and drainage.

The first results are promising and continuing *Sphagnum* establishment and growth has been observed. The next step is the development of machines and methods for managing and harvesting *Sphagnum* cultures on an industrial scale.

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