Effects of Rice-*Sphagnum* Intercropping on Rice Growth and Soil Bcaterial Community Structure

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Abstract

Sphagnum is an ecologically important peat-forming moss with substantial value in carbon sequestration, wetland restoration, and horticultural applications. Rice-*Sphagnum* intercropping has the potential to couple agricultural production with the cultivation of this high-value peat moss resource. To evaluate the ecological feasibility of rice-*Sphagnum* intercropping, field experiments were conducted to compare intercropping with conventional rice monoculture by examining rice growth, soil physicochemical properties, enzyme activities, and soil bacterial communities. Differences in intercropping performance were also assessed between low- and high-altitude sites at 100 and 800 m, respectively. The results indicated that rice-*Sphagnum* intercropping enhanced rice vegetative growth, while grain yield remained unaffected. Moreover, this intercropping system mitigated oxidative stress in rice, as evidenced by reduced malondialdehyde accumulation and stable superoxide dismutase activity. Altitude exerted contrasting effects on rice and *Sphagnum*: lower altitude favored rice growth and grain yield, whereas higher altitude promoted *Sphagnum* growth, biomass accumulation, and nutrient retention. In terms of soil properties, intercropping slightly reduced soil pH but did not significantly affect soil nutrient supply capacity in paddy fields. It moderately reduced the activities of soil oxidative enzymes, including phenol oxidase and peroxidase, thereby slowing the oxidative decomposition of organic matter and altering key biochemical processes related to soil carbon sequestration and nutrient cycling. Furthermore, the intercropping system reshaped soil bacterial community structure and increased the complexity of bacterial co-occurrence networks. Variations in bacterial communities were mainly associated with soil pH, carbon fractions, total nitrogen, and available phosphorus. Overall, rice–*Sphagnum* intercropping represents a promising cultivation strategy for integrating paddy production with the utilization of *Sphagnum* as an ecological resource. Further studies are needed to optimize establishment methods and field management practices in order to better balance *Sphagnum* cultivation with stable rice production.

Keywords

Sphagnum, *R*ice-*Sphagnum* Intercropping, Altitude, Soil Bacterial Community