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Utilization of peatlands as possible land resource for low-input agriculture: cultivation of Vaccinium species as an example

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The best way of soil protection is its sustainable and expedient use, which secures soils ecological functioning. Recent years, by exploitation of peat soils for their different use, has raised important issues concerning their input to global climate change as important source of greenhouse gases (GHG) emitters. The dynamics of GHG are determined by different factors as: site specific conditions including hydrology, soil type, vegetation, area management, including meteorological and climatic conditions. Therefore, in this current paper we are presenting the study results were we estimated CO_2, CH4 and N2O emissions from exhausted cultivated peatland with Vaccinium species and determined the soil chemical composition. For comparision a virgin state peatland was observed. The main goals of the paper are: (1) to present the experimental results of greenhouse gases generation and peat chemical composition (antioxidant activity of peat, C/N ratio, fiber content, water extractable phenolics) relationships on different microsites either on natural plant cover or Vaccinium species cultivation area on exhausted milled peat area; (2) to discuss how peat soil quality contributes to greenhouse gases emission; (3) and what kind of relationship reveals between low input agricultural system in which Vaccinium species are cultivated on exhausted milled peat area.

The study are is located in nearby Ilmatsalu (58°23'N, 26°31'E) in South Estonia, inside of which the three microsites are determined. Microsites are different from each other by exploitation and plant cover type. 1). Natural plant cover, 2). Cultivated area with Vaccinium angustifolium x V. corymbosum, 3). Cultivated area with Vaccinium angustifolium. The determined soil type according to WRB was Fibri Dystric Histosol. The main part of study focuses on the analyses of greenhouse gases. For this purpose the closed chamber method was used. The greenhouse gas samples were collected from spring to autumn 2011 throughout the vegetation period and analyzed in laboratory by GC. In June 2011 the soil samples were collected and chemical composition analyzed for Ntot, Corg, and related plant available nutrients, dry matter and ash content. Also, the water extractable phenolics were measured and the cellulose and lignin content was determined. Along the microsites the ratios of carbon to nitrogen (C/N) and of lignin to nitrogen (L/N) were calculated..

The higher CO_2 emission rate in the period from June to August was obtained from the natural plant cover area (range from 322 up to 517 mg/m2h). The emission rate from cultivated area with Vaccinium angustifolium x V. corymbosum was 67-305, from area with Vaccinium angustifolium was 17 – 324 mg/m2h. The maximum emission in October (67 mg/m2h) was recorded from the cultivated area with Vaccinium angustifolium x V. corymbosum plant cover area. During the whole period of measurements the higher methane emission rate was observed from area with natural plant cover – 18-189 μg/m2h. In the same time the lowest emission of N2O was produced on the natural plant cover area. Based on preliminary results we may conclude that greenhouse gas emissions from peat is dependent on the specific pedo-ecological conditions.