Controlled drainage on a cultivated peat soil

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Introduction

Controlled drainage (figure 1) is a promising method to diminish harmful environmental impacts of cultivated peat soils. Higher water table slows down the decomposition of organic material. There will be less greenhouse gas emissions to the atmosphere. The amount of mineralized nutrients is decreased, as well as water outflow from the field. This means less nutrient leaching to the waterways.

However, there is the question whether a controlled drainage system can actually keep the water table on the desired level in practical field conditions.

In this study, the water tables in two controlled drainage systems were monitored on a cultivated peat soil in southern Finland around a year.

Material and methods

The experimental field consisted of four plots with different moisture conditions (figure 2). Two of the plots were equipped with control wells (figure 3). The wells were supposed to keep the water table on a high level in the winter, and on a low level in the summer in order to make farming operations possible. Around the year, water table in plot 2 was kept higher than in plot 3. Wheat was grown on the field. The soil was moderately humified sedge peat soil. Thickness of the peat layer was more than one metre.

Water table level was measured by using groundwater pipes in the soil. The head of the pipes, water level in the control wells, and soil surface were leveled once or twice a month. At the beginning, there were only two groundwater pipes on each plot. Later, six additional pipes were installed; four close to the drains and two in the middle of the drains. Weather data was received from the nearby weather station (figure 4).

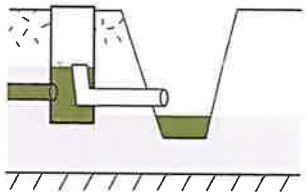


Figure 1. Controlled drainage keeps groundwater on a higher level than traditional drainage.

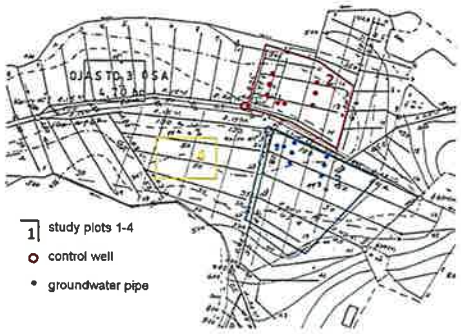
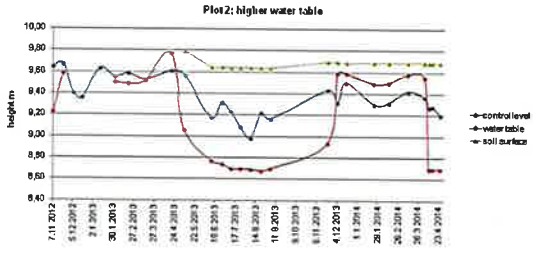
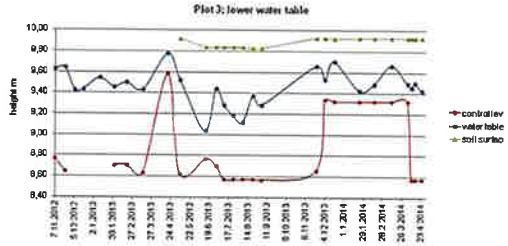


Figure 2. The experimental field.

Figure 3. A control well.





Figures 5 and 6. Levels of soil surface, ground water table (n=2), and water table in the control wells in two plots. There was a block in the collector pipe of plot 3 in the first half of the study period.

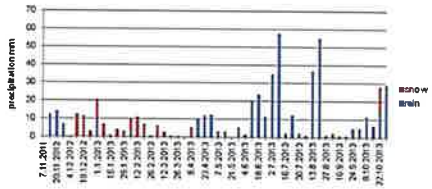
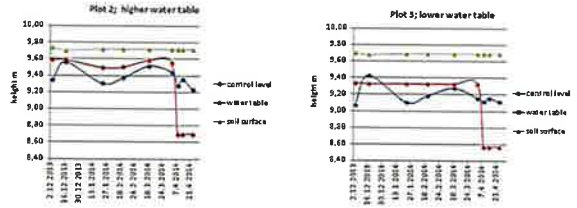


Figure 4. Rain and snow on the nearby weather station. Note: the weather data does not cover the whole study period.



Figures 7 and 8. Levels of soil surface, ground water table (n=6), and water table in the control wells in two plots in the winter and spring. The desired water table was 10 cm below the soil surface in plot 2, and 50 cm in plot 3.

Results

Control wells kept the water table on the desired level to some extend; water table on plot 2 was always higher than on plot 3, like intended. However, water table did not go down to the desired level in the summer but the soil remained wetter. (Figures 5 and 6.)

Water table tended to go lower than the desired level in winter when there was no input of water to the soil due to the frozen soil surface. When the ice melted, water table raised back to the desired level. (Figures 7 and 8.) It also raised when the water level in the control wells was raised, and when there was a lot of precipitation (figures 5 and 6).

When the water level in the control wells was lowered in the spring, the water table in the field lowered 10-20 cm in two weeks (figures 7 and 8).

Conclusion

Controlled drainage works in peat soils yet slowly.