Pertti Vakkilainen[1], Laura Alakukku[2], Merja Myllys[3], Jyrki Nurminen[4], Maija Paasonen-Kivekäs[1], Markku Puustinen[5], Rauno Peltomaa[4] and Helena Äijö[4]

[1]Helsinki University of Technology, Water Resources, pertti.vakkilainen@tkk.fi

[2]University of Helsinki; Department of Agrotechnology; [3]MTT Agrifood Research Finland; [4]Field Drainage Association, Finland; [5]Finnish Environment Institute

Nutrient load from two drainage systems

– a field scale research project on clay soil

Method I

The new pipes were laid between the old ones and connected to the existing collector.

In method I the additional drainage was done with a drainage trencher, plastic pipe and gravel was used as envelope material.

Gravel was filled to the top (blind inlet) every 8 meters. The trenched soil was left to dry for a week after which it was used to fill up the trench.

The subsurface and surface waters from each plot are measured. The flow-weighted water samples are collected through an electromagnet valve to plastic containers for further sampling and chemical analyses.

Introduction

In the southern and the south-western parts of Finland 75% of the arable land has subsurface drainage. The typical drain depth is 1,0-1,2 m, gravel is used as envelope and the drain spacing varies mostly between 12 and 26 meters depending on the soil type.

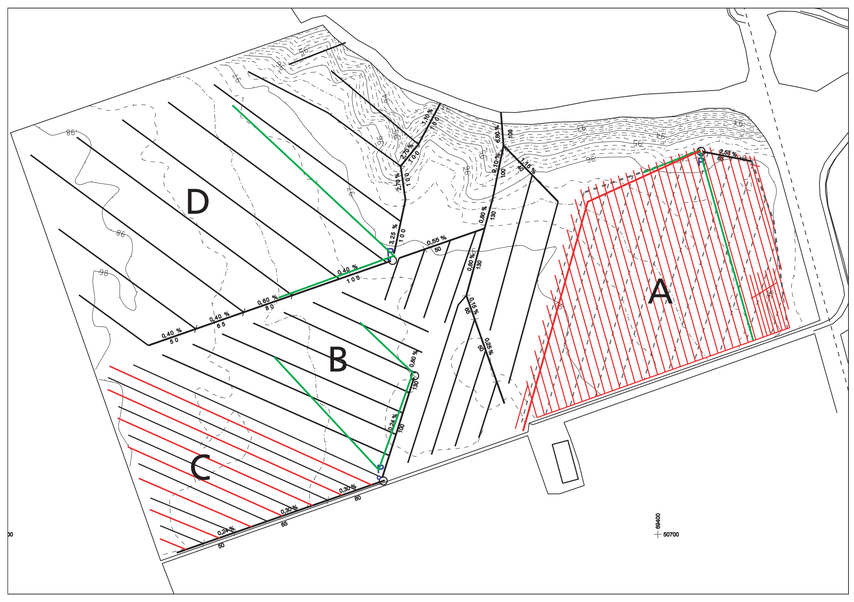
In some areas gravel is not readily available and it is nowadays also rather expensive. Recently some contractors have been using pipes with thin envelopes (<1 mm textile envelope) with very narrow drain spacing. The state subsidizes subsurface drainage with some conditions. Currently the conditions do not include these thin textile enveloped systems. Therefore there is a need for research on these filter materials. The objective of the research is to compare different drainage methods. The results from the calibration period are presented.

Field site and measurements

In method I gravel is used as an envelope and the drain spacing is 8 m. In method II very thin textile (<1 mm) is used as an envelope and drain spacing is 6 m. The aim is to find out how the different drainage methods affect crop production and nutrient load in both drainage waters and surface runoff.

The research is carried out on a field at Jokioinen in south-western Finland. The soil is heavy clay soil and the mean slope is 1%. The existing tile drainage pipes were laid in 1954 using 16 m spacing and average depth of 1 m. The size of the field is 6 ha and it consists of 3 plots each with a separate drainage system. Two different types of new additional drainage systems were built into two of the plots in summer of 2008 and the third was left as a control plot.

The subsurface and surface waters from each plot are measured. The flow-weighted water samples are collected through an electromagnet valve to plastic containers for further sampling and chemical analyses. Total phosphorus (TP), dissolved orthophosphate (PO4-P), total nitrogen (TN), ammonium nitrate (NH4-N), nitrate nitrogen (NO3-N) and solid substances (SS) are determined from the samples.



The additional drainage was done on plot C with method I and on plot A with method II. Plot B was left as a control plot

Method II

In method II a very thin textile (<1 mm) was used as an envelope. Drain spacing was 6 m. The old pipes were destroyed.

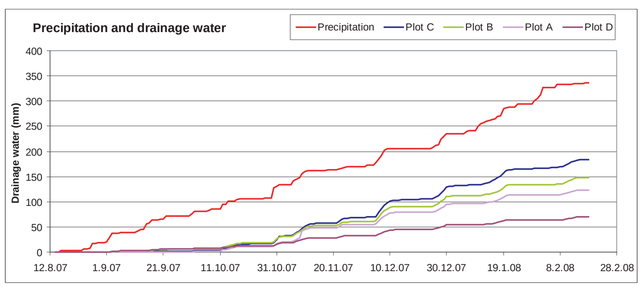
The drainage plow is equipped with a device that installs the envelope around the pipe on site before laying the pipe.

Drainage plow was used in this method. The trench closes right after the pipe laying.

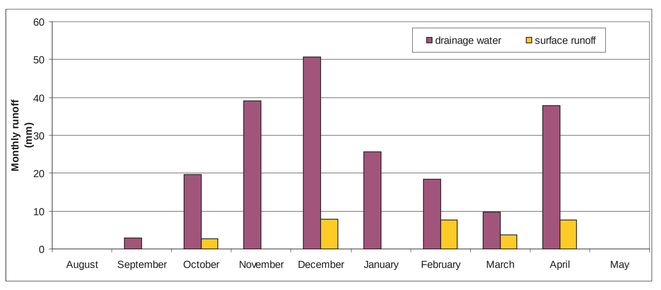
Embankments are used to help collect surface runoff.

Results from the calibration period

Examples of measured drainage water, surface runoff and the nutrient losses are from the calibrating period before the new pipes had been laid out. Application of manure was carried out in autumn 2007. The measurements will continue and will show how the different drainage systems will work.



Precipitation and drainage water during 08/2007 - 05/2008



Monthly drainage water and surface runoff during 08/2007 - 05/2008

Measured average losses during 09/2007 - 02/2008 (6 months) in drainage water and in surface runoff.

	TP [kg ha^{-1}]		DP [kg ha^{-1}]		TN [kg ha^{-1}]		SS [kg ha^{-1}]	
	Drainage	Surface	Drainage	Surface	Drainage	Surface	Drainage	Surface
Plot A	1.2	0.2	0.1	0.02	14.6	1.1	826	133
Plot B	1.5	0.3	0.2	0.02	15.1	2.3	1024	171
Plot C	1.7	0.1	0.3	0.01	15.5	0.8	923	46
Average	1.4	0.2	0.2	0.0	15.1	1.4	924	117

Concentrations of Phosphorus, nitrogen and total solids in drainage water and in subsurface runoff.