Long-term monitoring of nutrient losses from arable clay fields in southern Finland

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INTRODUCTION

The aim was to find out how the change in production direction affects to

- Runoff / runoff ratio
- Nutrient and sediment concentrations
- Nutrient and sediment loads



FIELD PLOT 1



FIELD PLOTS

FIELD PLOT 2

- Subsurface drains 5.7 ha
- Slope 1 %
- Subsurface drained in the 1940s
- Drain spacing 16 m
- Clay soil

CULTIVATION AND TILLAGE

CEREAL CROPPING 2007 – 2011

- Spring and/or autumn crops
- Ploughing or lightened tillage
- Nitrogen fertilization (ca. 130 kg ha⁻¹ a⁻¹)
- Phosphorus fertilization (10 kg ha⁻¹, 2007 and 2009)

GRASS 2012 – 2019

- Organic perennial grass cultivation
- Harvest once a year (fresh fodder)
- No fertilization

MEASUREMENTS

Drain discharge and

tillage layer runoff

Continuous measurement

Quality of runoff water

- Flow-weighted composite samples
- Total Phoshoprus (TP) and PO_4 -P
- Total Nitrogen (TN) and NO₃-N and NH₄-N
- Total Solids (TS)

Other measurements

 Precipitation, groundwater level, depth and water equivalent of snow, frost depth

Subsurface drains 4.7 ha

- Slope 5 %
- Subsurface drained in the 1940s
- Drain spacing 16 m
- Clay soil

CULTIVATION AND TILLAGE

CEREAL CROPPING 2007 – 2010

- Winter wheat or malting barley
- Ploughing
- Nitrogen fertilization (ca. 135 kg ha⁻¹ a⁻¹)
- Phosphorus fertilization (11 kg ha⁻¹, 2008 and 2010)

PASTURE GRASS 2011 – 2019

- Organic pasture for beef cattle
- Grazing from May to October
- No fertilization, additional feeding

FIELD PLOT 2

FIELD PLOT 1

RESULTS 2008 – 2019







Monthly load of soluble phosphate phosphorus (average value and minimum and maximum) in the years of cereal cropping (1) and grass cultivation (2).

Load (drain discharge + tillage layer runoff) (kg ha⁻¹ a⁻¹) in cereal cropping and grass cultivation (3).







Monthly load of soluble phosphate phosphorus (average value and minimum and maximum) in the years of cereal cropping (4) and pasture grass (5).

Load (drain discharge + tillage layer runoff) (kg ha⁻¹ a⁻¹) in cereal cropping and pasture grass (6).

Cereal cropping ⇒organic grass (slope 1%)

- Runoff (drain discharge/tillage layer runoff): no change
- Total nitrogen load decreased clearly
- Sediment load decreased slighty
- Total phosphorus load increased slighty
- Soluble inorganic phosphate phosphorus (PO₄-P) load increased clearly

Cereal cropping -> organic pasture (slope 5%)

- Proportion of tillage layer runoff increased
- Total nitrogen load decreased clearly
- Sediment load decreased clearly
- Total phosphorus load decreased clearly
- Soluble inorganic phosphate phosphorus (PO₄-P) load increased clearly

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