VESIENSUOJELUN TEHOSTAMIS-OHJELMA

Treatments in agriculture – the arable lands, application of structural lime, gypsum, and wood fiber for reduction of nutrient load

Baltic Sea City Accelerator Club Workshop, 26 – 28 April, Helsinki

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Studies of Water Protection Programme

Three projects funded by the Ministry of the Environment as a part of the Water Protection Programme decided to publish their results together:

- Fibre sludge as a water protection method in agriculture (FIBRE), 2019–2021
- Structure lime as a water protection method in agriculture (STRUCTURE LIME), 2019–2021
- Spreading gypsum on fields in the Archipelago Sea's catchment area (GYPSUM)

Material awailable

- Gypsum, fibre, and structure lime – guide for farmers
- Four brief videos:
    - Introduction: How to choose the right amendment
    - Presentation of each amendment: Gypsum, Soil improvemment fibres, and Structure lime
- The webinar held on 8 December 2021 presented the key results of three projects including a panel discussion
- All the material translated into English and Swedish is available: https://proagria.fi/kipsikuiturakennekalkki

Gypsum, fibre and structure lime – a guide for farmers

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Introduction: Soil amendments

- Soil improvement fibres
    - processed from fibre sludge generated in the production of paper, board, and pulp in the forest industries.
- Gypsum ($CaSO_4 \cdot 2H_2O$)
    - a by-product of phosphoric acid manufacturing, and smaller volumes are generated in flue gas scrubbing at coal-fired power stations.
- Structure lime
    - a mixture of agricultural lime ($CaCO_3$) and active lime (CaO or $Ca(OH)_2$).

When considering which soil amendment is the best choice for your field, focus on the soil's pH value, electrical conductivity, nutrient content, soil type and clay content.

Gypsum *and* ***structure lime*** *increase soils' electrical conductivity.*
Structure lime *increases the pH level of soil.*
Soil improvement fibres *boost microbial activity in soil.*
Soil improvement fibres *except zero fibre contain nutrients and are suitable for organic farming.*

	Soil improvement fibres	Structure lime	Gypsum
SOIL TYPE	Mineral soils	Clay soils	Clay soils
SOIL pH	No impact, or a slight increase in the case of lime-stabilised fibres	Increase	May decrease temporarily, but this has no impact on cultivation
ELECTRICAL CONDUCTIVITY	No impact	Increase	Clear increase
FERTILISING IMPACT	• No impact when using zero fibres • N, P, K, S, Ca, and Mn when using nutrient-rich fibres • For nutrient-rich fibres, P and soluble N to be considered in additional fertilisation	Ca and Mg (product-specific)	• Ca, S and P • Not to be spread on field where the Mg or K level is low or fairly low
RECOMMENDED SPREADING AMOUNT	20–60 tonnes per hectare	1 tonne of active lime per hectare, i.e., total of 2.5–7 tonnes per hectare	2.5 tonnes per hectare; 4 tonnes per hectare in water protection projects
ELIGIBILITY FOR ORGANIC FARMING	Yes	No	No; natural gypsum permitted

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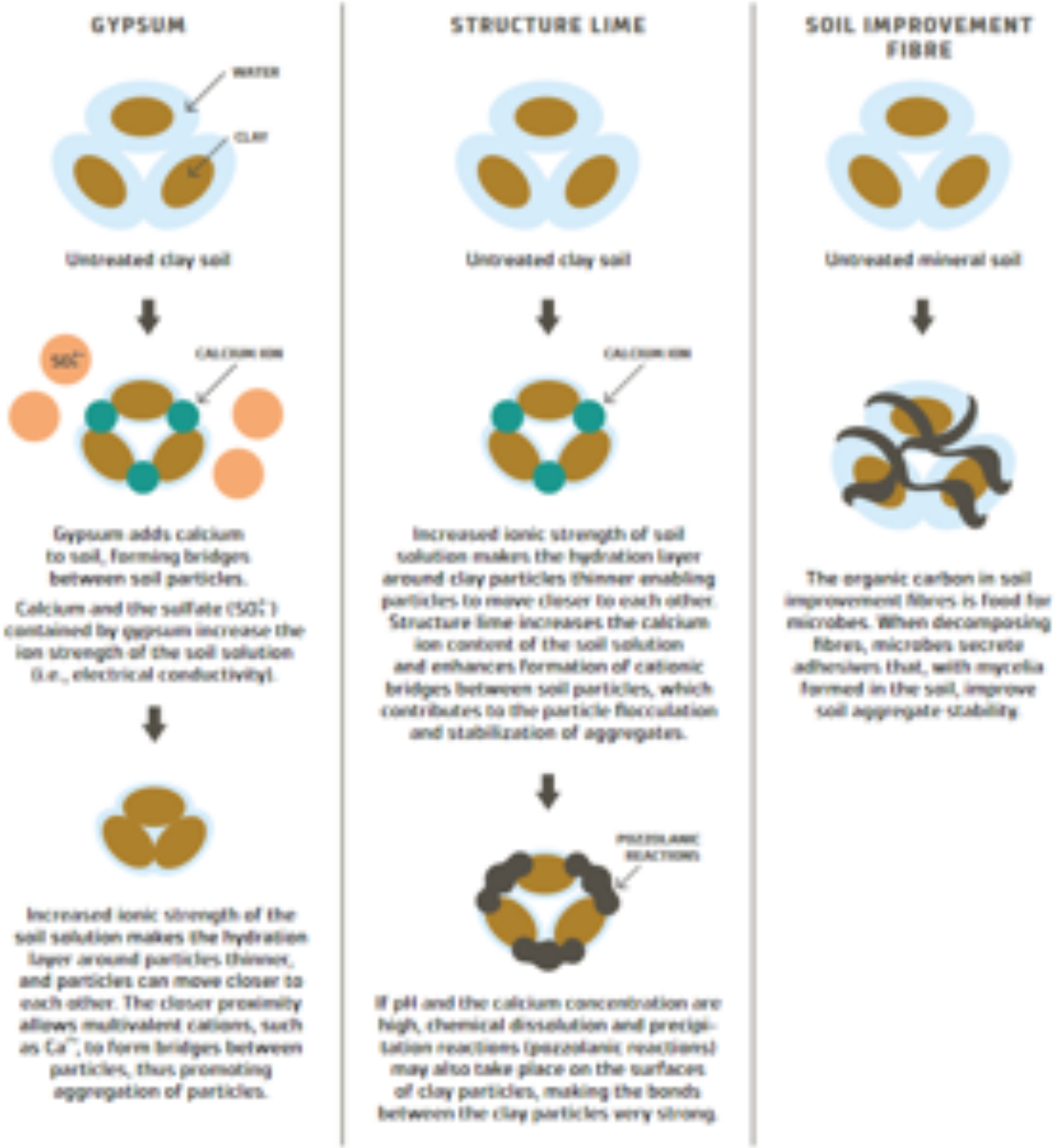
How do the amendments improve the soil aggregate stability?



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A FARMER'S EXPERIENCES

TAPIO ANTTILA FROM MYRSKYLÄ

Tapio Anttila, a farmer on the Tattari estate, has been spreading fibres on his fields regularly since 2015. Over time the organic matter content and water retention capacity of his fields have improved, which was favorable during last summer's drought.

PHOTO: Mediafarmi

I've used nutrient-rich fibres on my organic fields for nearly seven years now. The organic matter content of Finnish fields is low, and the main reason for using fibres is to improve the organic matter content of my fields. Earthworms thrive in a field with a high organic matter content, which is important for soil fertility. My fields mainly consist of clay soil, and I also wanted to use fibres to improve their water retention capacity. Although we have rainy summers here in Finland, water shortage was experienced this summer, for example. The higher the organic matter content, the better the soil retains water.

I transport fibres myself and order spreading from a service provider that was once recommended to me. After spreading, I cultivate the fibres in the surface layer at a depth of roughly 5-10 cm. Fibres are transported here during the winter

Fibre sludge as a water protection method in agriculture (FIBRE)

Jaana Uusi-Kämppä[1], Risto Uusitalo[1], Kimmo Rasa[1], Johanna Leppänen[1] and Helena Soinne[1]
Paula Luodeslampi[2]
Janne Heikkinen[3]

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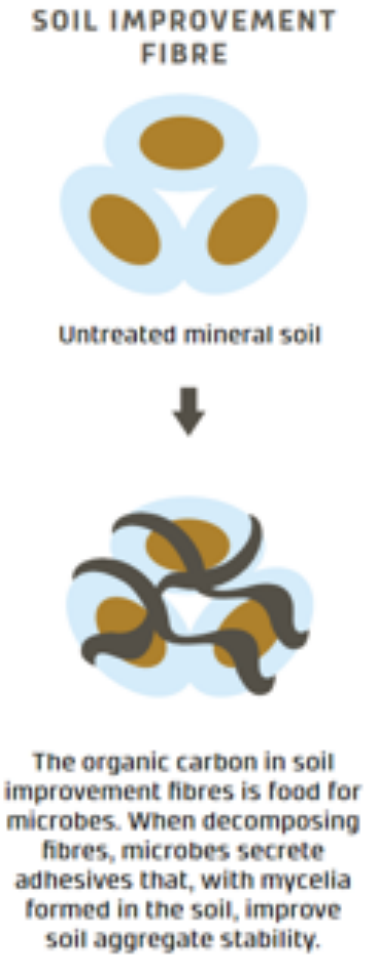
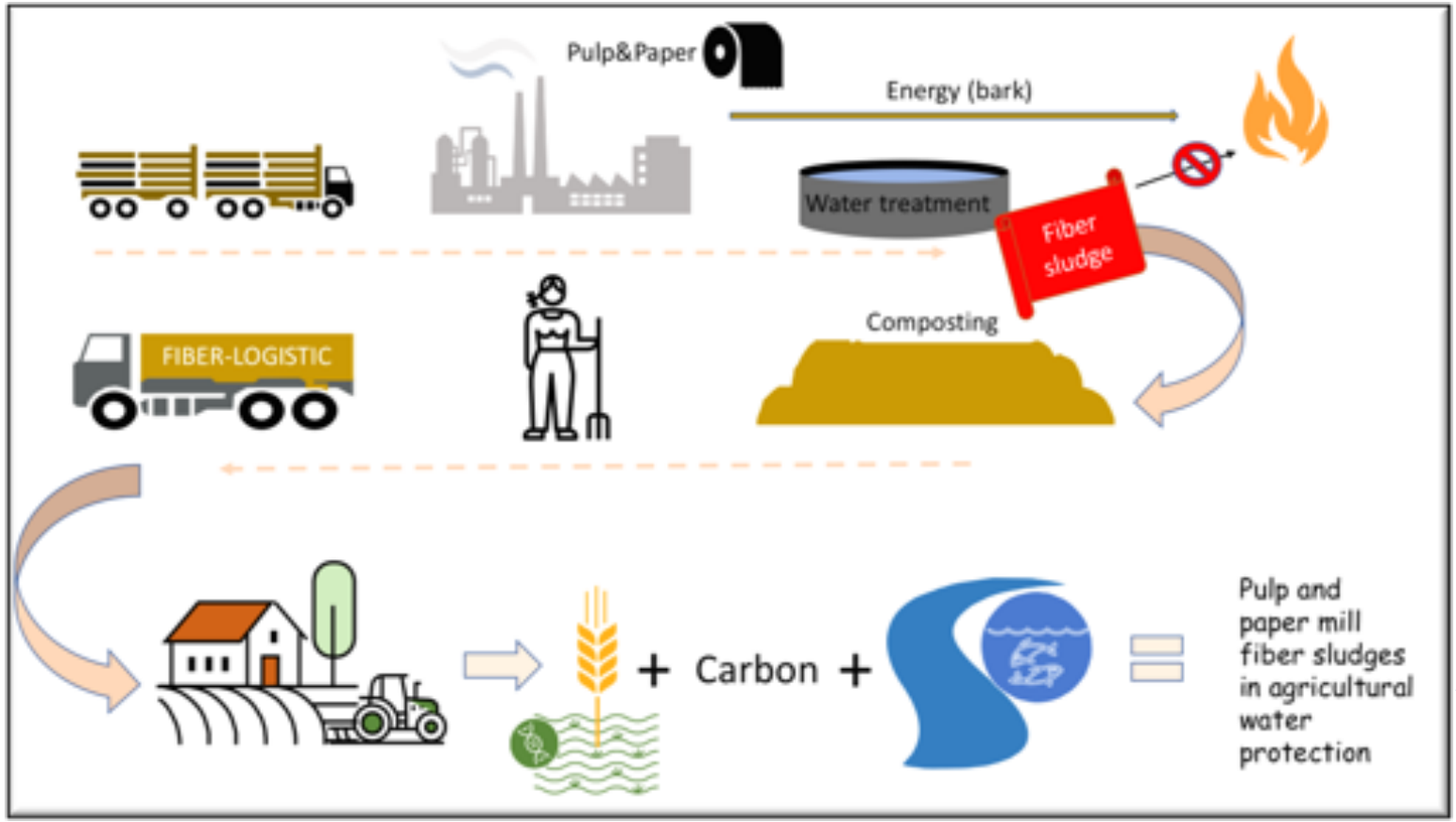
[2] Water Protection Association of the River Vantaa and Helsinki Region
[3] The Environment Centre of Keski-Uusimaa

What are soil improvement fibres?



- They are processed from fibre sludge generated in the production of paper, board, and pulp in the forest industries.
- Zero fibre (nutrient poor), Composted nutrient fibre, Lime-stabilized nutrient fibre



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Field experiment in Jokioinen (2015–)

Fig: Jaakko Heikkinen, Luke

Treatments:

- Zero fibre
- Composted nutrient fibre
- Lime-stabilized nutrient fibre
- Control (No fibre)

Spreadings of fibres

- 1st in autumn 2015
- 2nd in autumn 2020

Soil monolites for rainfall simulation

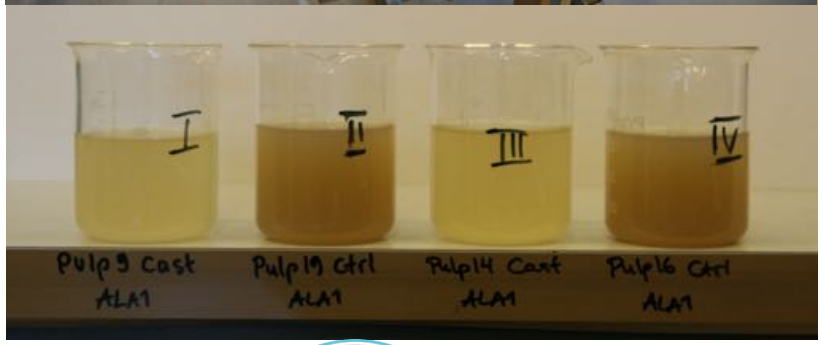
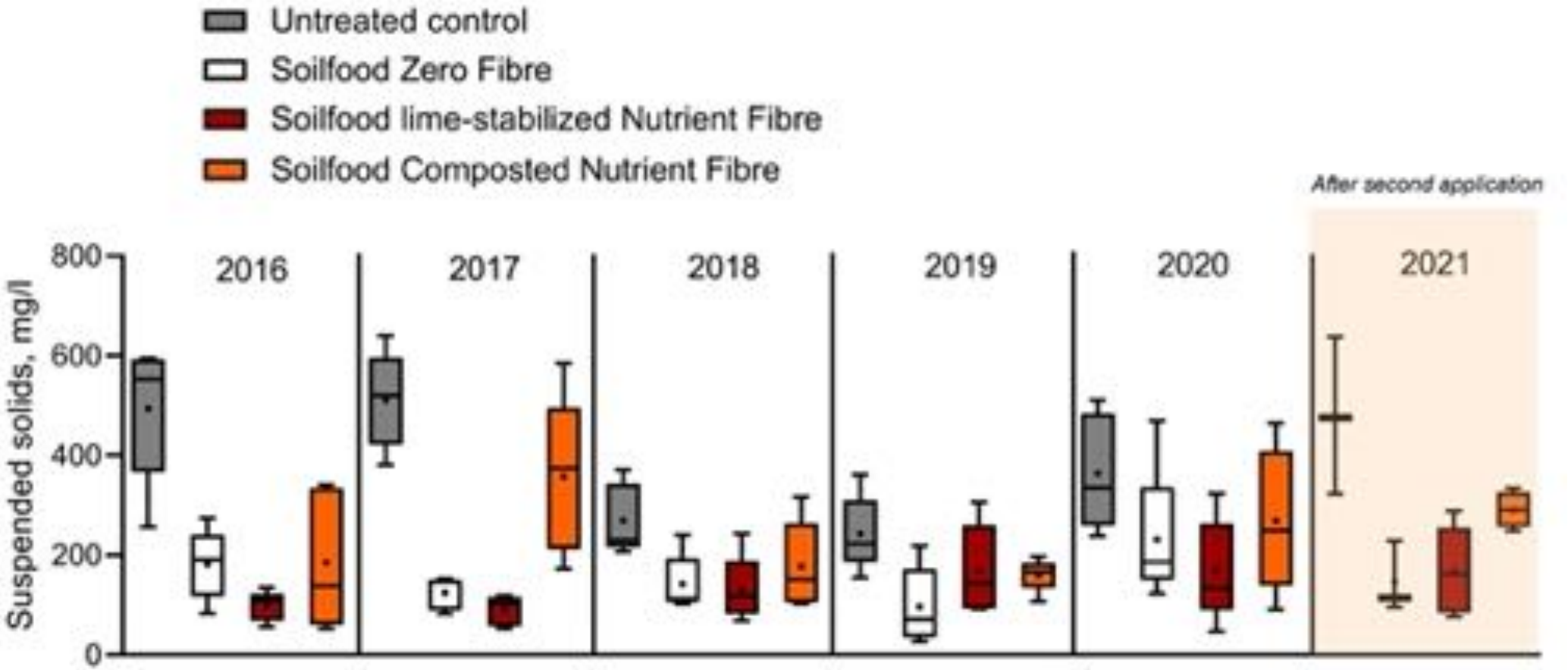


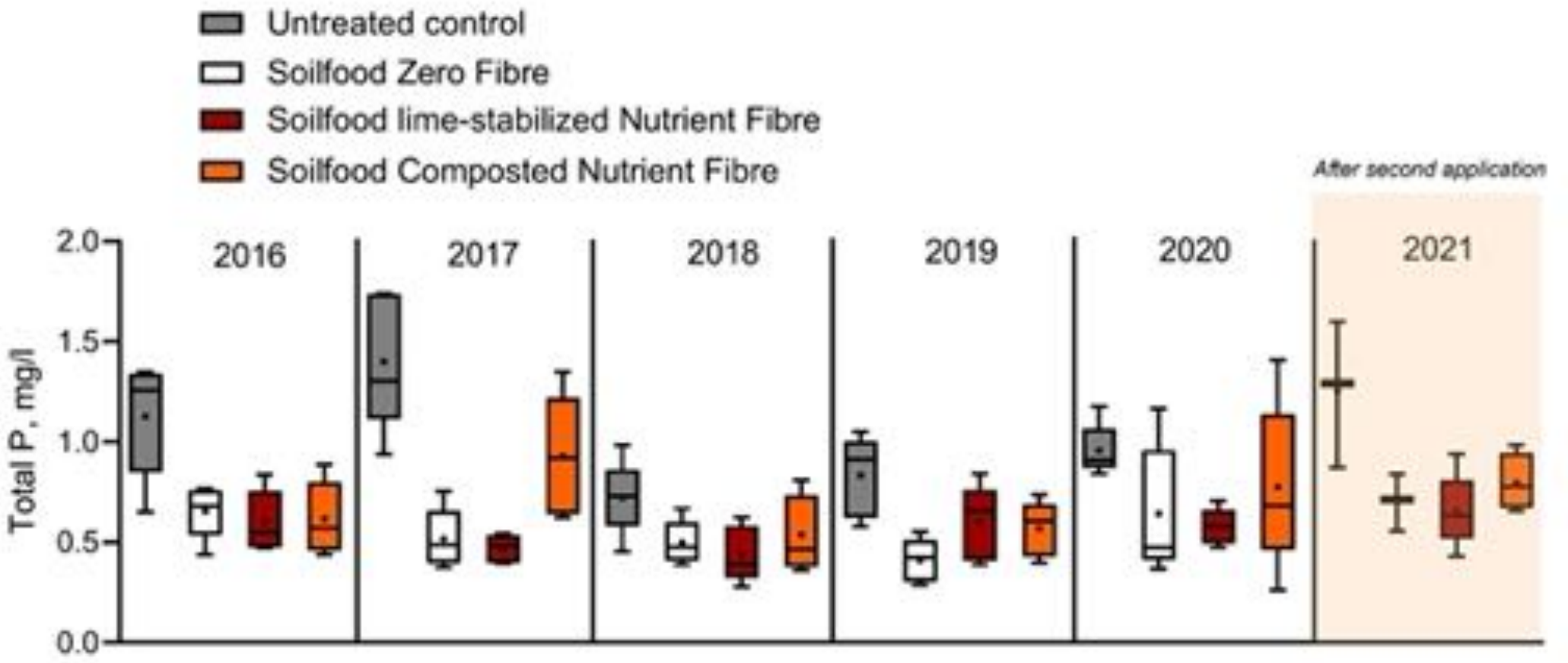
Fig: Johanna Nikama, Luke

Suspended solids in runoff



(NSPPulp project and SoilFood)

Total phosphorus in runoff



(NSPPulp project and SoilFood)

Catchment scale study (2019–)

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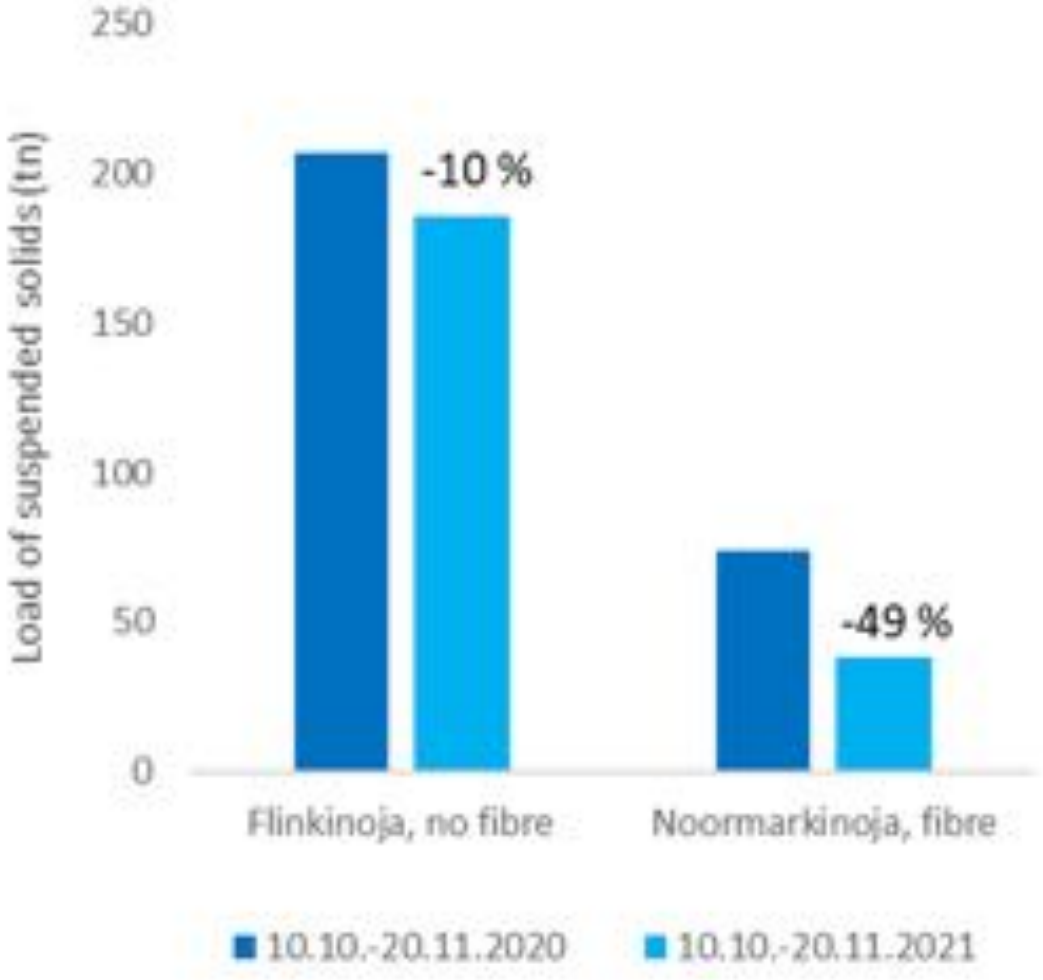
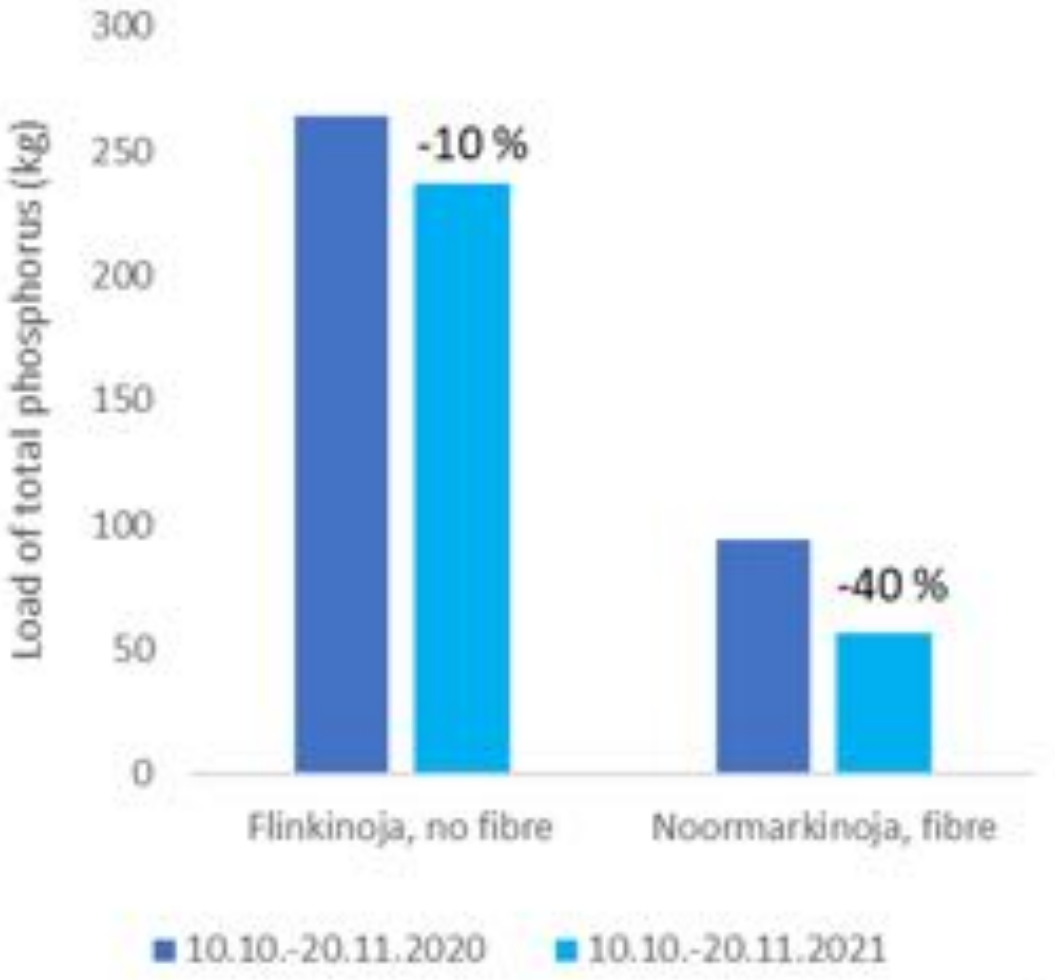
Fig: Paula Luodeslampi

Two catchment areas in Tuusula

- **Noormarkinoja**: field area 157 ha
  - composted nutrient fibre (40 tn/ha) was spread in Sept. 2020 (15 ha) and Sept. 2021 (63 ha)
- **Flinkinoja:** untreated control area (field area 379 ha)
- Continuous water quality monitoring (turbidity, NO_3-N, TOC, EC, ditch water level) started in autumn 2019
- Monitoring continues

Loads of suspended solids and total phoshorus in the cathment study (preliminary results)





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The investigations continue

- Jokioinen: The effects of the second fibre spreading on the yield as well as chemical, physical and microbiological properties of soil and runoff.
- Tuusula: The catchment scale study monitors the effects of the fibre on the suspended solids and nutrients in runoff water and whether the positive effects last as long as in the Jokioinen field study.
- A new field experiment study in Jokioinen (2021–)
  - How does the fibre affect losses of suspended solids and nutrients in surface runoff?

Tips for spreading fibre (1/2)

- Suitable for clay soils and mineral soils with low organic matter content.
- After harvest early crops or the termination of grass and caraway crops
- Boost microbial activity and nitrogen immobilization.
- A two-week safe period between the spreading of fibres and sowing.
- Zero fibres can be spread when terminating crops that contain plenty of nitrogen.
- Eligibility for organic farming.

Fig: Paula Luodeslampi

Tips for spreading fibre (2/2)

- Fibre spreading is allowed April 1 – October 31 e.g., with equipment suitable for manure application, and mulching within 24 hours.
- The amounts of phosphorus and soluble nitrogen in the nutrient fibres will be considered in fertilization.
- Zero fibre reduces the amount of plant available nitrogen in the soil as well as nitrogen leaching.
- The cadmium concentration of the fibres must be considered. The Cd concentration limit is 1.5 mg/kg dry matter and the amount of Cd added through fibres cannot exceed 7.5 g/ha.

Fig. Paula Luodeslampi

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Thank you!

Paula Luodeslampi, VHVSY
Janne Heikkinen, KUYK
Kimmo Rasa, Luke
Helena Soinne, Luke
Risto Uusitalo, Luke
and
Farmers of FIBRE-project

NSPPulp project and SoilFood

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