

Pilot Programme for Nutrient Recycling – Results and Progress 2016–2024



Elinkeino-, liikenne- ja
ympäristökeskus



Maa- ja metsätalousministeriö



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EDITORIAL

Promoting Nutrient Recycling Across Government Terms

Prime Minister Juha Sipilä's Government Programme "Finland, a Land of Solutions" included more than 20 key projects. The aim of these projects was to achieve central objectives. This also meant quickly implemented legislative projects, so that actions could be set in motion. The Government Programme introduced a new way of working – an experimental culture.

I received a phone call from the Ministry of Agriculture and Forestry in the autumn of 2015. Marja-Liisa Tapio-Biström called and explained that the Ministry was preparing the implementation of the project "Breakthrough in Circular Economy – Improving the Condition of Water Bodies", which was part of the key project package "Bioeconomy and Clean Solutions". The project would be carried out through a nationwide programme, for which national funding had been allocated. The national implementation of the programme was offered to the ELY Centre for South Ostrobothnia. The programme was new, and all the systems related to its implementation would be prepared "from a clean slate".

A meeting was arranged at the Ministry, and on the way to Helsinki we thought: yes, we'll take this on, even though we didn't know exactly what the task would entail or with what resources we would manage it. In South Ostrobothnia, we've never turned down challenges.

The preparation of the **Pilot Programme for Nutrient Recycling** started with the drafting of a Government Decree. Drafting the legal text, taking into account state aid regulations, was not at all simple – and there was pressure of time as well. The decree entered into force in May 2016.

Preparations for implementation proceeded in parallel with the decree drafting: the selection of projects to be funded and the criteria for selection, application and



"In South Ostrobothnia, we've never turned down challenges."

decision forms, etc. The application process opened in the summer of 2016, and the programme implementation began.

The pilot programme continued under Prime Minister Marin's term and expanded from a research and innovation programme to also include nutrient recycling investments.

We have been involved in the programme's implementation for nine years. Our own experience and expertise have grown, both in bioeconomy and nutrient recycling as well as in building a new support system.

In this publication, we present nutrient recycling and the programme with project examples.

Many thanks to the Ministry of Agriculture and Forestry for the excellent cooperation!

Ritva Rintapukka, Head of the Rural Unit
ELY Centre for South Ostrobothnia

Nutrient Recycling at the Core of a Sustainable Food System

The phosphorus in mineral fertilizers needed for crop cultivation in Finland could almost entirely be replaced with phosphorus reserves found in organic side streams, writes Sanna Tikander from the Ministry of Agriculture and Forestry.

Nutrient recycling refers to the recovery, processing, and circular use of nutrients – such as phosphorus and nitrogen – for example in food production and industrial processes. The sustainable use of nutrients and avoiding waste are essential parts of the whole.

Large amounts of nutrients are wasted at different stages of the food system, from primary production to households and waste management. For example, only 20–25 percent of mined phosphorus actually ends up on the plate. Nutrients discharged into water bodies cause eutrophication, while ammonia emissions have negative climate impacts. Above all, essential and costly production inputs are being wasted.

Nutrient recycling is therefore at the very core of a sustainable food system. The greatest circular economy potential lies in the more efficient use of different organic side streams as raw materials for renewable energy and fertilizer products. For instance,

in the longer term, the phosphorus in mineral fertilizers required for Finland's current crop cultivation could almost entirely be replaced by phosphorus reserves contained in organic side streams.

Nutrient recycling can be enhanced through various closed-loop biomass measures, which reduce dependence on imported fossil-based nutrients and strengthen food security and energy self-sufficiency, while also generating environmental and climate benefits. Recycled biomass can also be used to produce peat substitutes for growing media and bedding, as well as other products, industrial raw materials, and valuable components. These measures can also accelerate carbon sequestration and storage.

Within the administrative branch of the Ministry of Agriculture and Forestry, the nutrient recycling programme has been carried out consistently across government terms. The goal is to improve Finland's self-sufficiency and food security by enhancing the circulation of materials and nutrients.

Through the Pilot Programme for Nutrient Recycling, broad support has been given to nutrient circular economy processes, including nutrient recovery and production, product development, logistics and service solutions, as well as sectoral expertise and cooperation.

In addition to the national pilot programme, nutrient recycling is promoted through the EU's Common Agricultural Policy, which has financed e.g. investments in bioenergy and manure management on farms and in rural



enterprises, as well as cultivation measures and expertise that advance nutrient recycling. The overall package also includes the national nutrient recycling subsidy for biogas plants, energy subsidies for biogas investments, and transport infrastructure investments supporting biomass and biogas logistics to ensure that nutrients reach the places where they are needed.

Together with other promotion measures, the Pilot Programme for Nutrient Recycling has made a significant contribution to the progress of the nutrient circular economy. New innovations, investments and products are continuously emerging in the field, but mainstreaming nutrient recycling requires both large-scale systemic solutions and targeted solutions for smaller process components. More actors, bold partnerships, and cross-sectoral cooperation between all administrative branches are also needed.

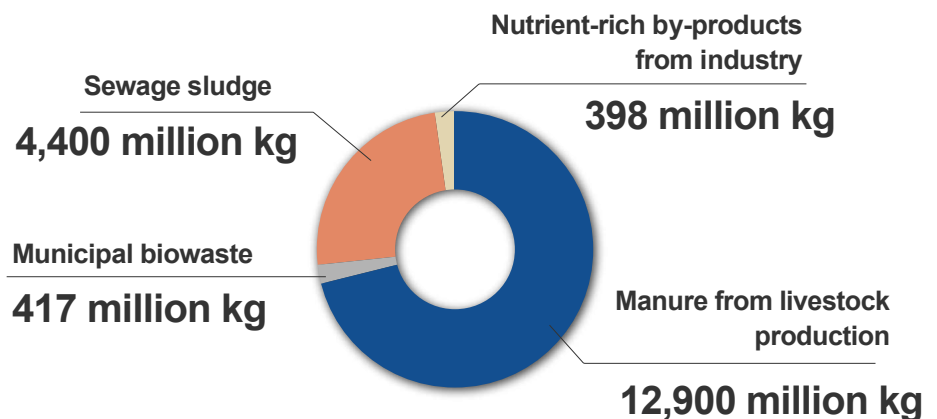
Sanna Tikander
Senior Specialist
Ministry of Agriculture and Forestry



Annual Amounts of Biomass in Finland

The nutrient recycling indicator compiled by the Natural Resources Institute Finland (LUKE) shows the recycling potential of different biomass streams.

Take a closer look at the indicator on LUKE's website:



From Pilots to Investments

The Pilot Programme for Nutrient Recycling, funded by the Ministry of Agriculture and Forestry and administered by the Centre for Economic Development, Transport and the Environment for South Ostrobothnia (ELY Centre), has been implemented since 2016. The first programme period ended in 2018. The second programme period began in 2020 and was extended in 2022 when additional funding was granted from the government's security of supply package.

The main objective of the pilot programme is to promote the processing of nutrient-rich biomass so that nutrients can be recovered, recycled, and reused. Project topics must be related to biomass processing, the production and development of recycled fertiliser products, the logistics and service solutions of nutrient recycling, and increasing the degree of refinement of biomass-based products.

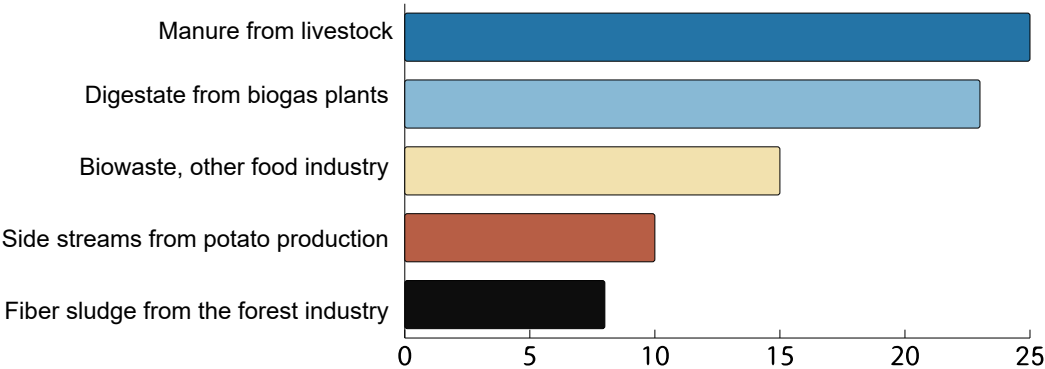
Funding can be applied for both research, development, and innovation (RDI) projects as well as for investments aimed at starting production. This is a nationwide programme, and funding is mainly intended for SMEs. However, most projects have been carried out in Southern and Western Finland and in Northern Ostrobothnia, where business activity in this sector is particularly active.

The programme has provided companies focusing on **nutrient recycling** with opportunities for product development, research, and piloting to ensure that their services and products are credible and tested. As its name suggests, the pilot programme provides a funding channel and opportunities for new and innovative trials. Thus, the outcomes of projects cannot always be fully anticipated. The programme's aim is to promote new business related to nutrient recycling and to facilitate the introduction of new recycled fertilizer products to the market.

During the first programme period (2016–2018), a total of 38 RDI projects were funded, with an allocation of approximately 7 million euros. In the second period, from 2020 until autumn 2024, 65 RDI projects and 9 investment projects have been funded. Approximately 9 million euros have been granted for RDI projects and around 11 million euros for investments.

The majority of the RDI projects, 74 percent, have focused on various trials and pilot schemes. The themes and raw materials studied have varied, but the projects have tested different nutrient processing methods on both small and larger scales.

The most commonly used biomass types (number of cases) in projects funded by the Pilot Programme for Nutrient Recycling.





"The pilot programme has provided companies focusing on nutrient recycling with opportunities for product development, research, and piloting to ensure that their services and products are credible and tested."

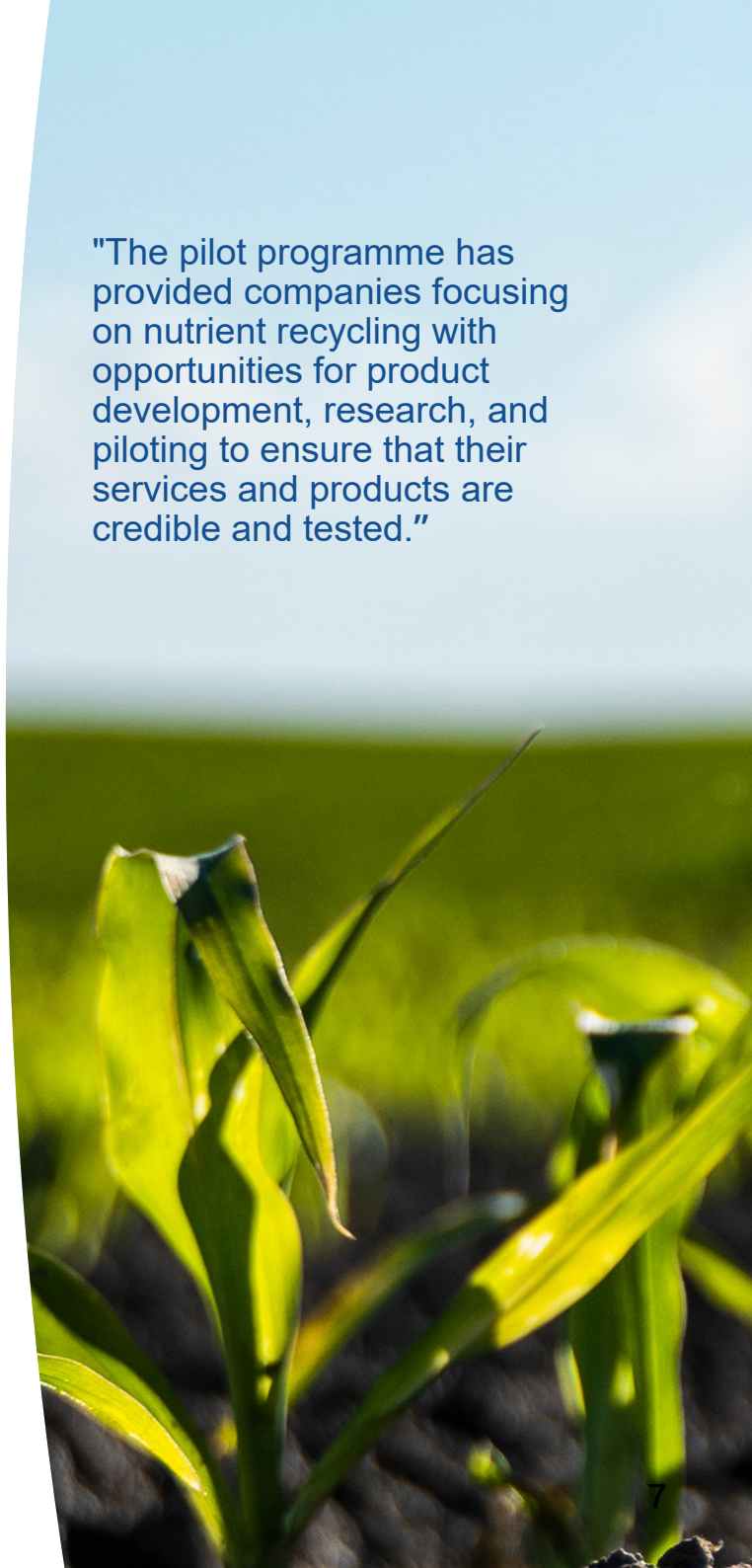
Most of the projects have concentrated on developing and producing recycled fertilizer materials or soil improvers. Another goal has been to replace peat in growing media and bedding applications. The projects have shown a clear ambition toward replicable and scalable solutions.

Investments related to nutrient recycling and carbon sequestration have also been supported in the current programme period. Four projects have already been completed, targeting the recycling of different types of biomass and the nutrients and organic matter they contain. At the same time, these projects contribute to reducing the environmental impacts of agricultural production.

The nutrient recycling sector has developed during the programme's implementation. Small-scale trials have evolved into larger-scale research, the improvement of existing activities, and investments. It can be said that the Pilot Programme for Nutrient Recycling has contributed not only to creating a cleaner environment but also to developing new solutions for nutrient recycling.

Anja Norja

Specialist, Business Financing
ELY Centre for South Ostrobothnia



Expert Juha Näkkilä from the Natural Resources Institute Finland and project worker Mari Kosonen from the Finnish Glasshouse Growers' Association presented the project's cultivation trials in summer 2023.



Companions for Vital Horticultural Peat

Horticultural peat is essential for Finland's greenhouse sector due to its irreplaceable properties. Following the phase-out of energy peat production that began in 2020, concerns arose within the Finnish Glasshouse Growers' Association about the availability of horticultural peat.

"Horticultural peat is absolutely critical for greenhouse cultivation in Finland, because for certain crops it is practically the only substrate used. It's very important to safeguard the conditions for greenhouse cultivation", explains **Mari Kosonen**, greenhouse cultivation expert and project worker for the "Companions for Horticultural Peat" project at the Finnish Glasshouse Growers' Association.

The research project "Companions for Horticultural Peat", launched by the Association in 2022, aimed to identify new domestic substrate materials for

cultivation to partly replace peat in substrates. The Natural Resources Institute Finland (LUKE) acted as a co-implementer. Substrate trials were conducted at LUKE's Piikkiö research station with tomato, potted lettuce, cucumber, poinsettia, and pelargonium.

"The wide range of crops is due to the fact that different plants require different irrigation and fertilization methods. The properties of the substrates influence how they can be irrigated", explains **Juha Näkkilä**, Expert at LUKE.

Peat-based substrates are also important in Finland for forest seedling production. Trials with forest tree seedlings were carried out at LUKE's Suonenjoki research station with pine, spruce, and birch.

Moss and Wood Fiber Performed Best

The research project was preceded by a survey carried out by LUKE, in which potential alternative substrate materials were tested. Substrate producers supplied various materials, including moss, wood fiber, and common reed. In addition, a few trials included a substrate mix developed at LUKE containing moss and digestate residue.

How do the costs of alternative growing media compare to horticultural peat?

"That's a very good question, but it was left outside the scope of the project. The test substrates were provided by the growing media suppliers involved in the project, so it was up to them to decide whether the mixes were realistic", says Mari Kosonen.

"It's very important to ensure that the conditions for greenhouse cultivation are maintained."

According to the project results, up to 50 percent of other materials can be mixed with horticultural peat without reducing yield or market quality. The results also showed that even a relatively small mix (about one-third or one-quarter peat) significantly improves the properties of the substrate. The project found that among completely horticultural peat-free growing media, the best performing ones were those containing moss and wood fiber. In contrast, compost-based growing media or those containing digestate residue generally did not perform as well without major changes to cultivation recipes and techniques.

Watch the video on
YouTube!



Substrates replacing peat were tested e.g. for growing these geraniums.



Redono Developing a Local Food Production Concept

Photos: Redono



Redono's CEO Henri Laine.



Redono's project worker Tiia Laine working with a hydroponic system for herb cultivation.

In 2016, **Henri Laine** began to think about what he could do for the planet and for a better future. At the time, he was working with industrial water purification. He was particularly concerned about access to clean food and water.

"In industry, not all side streams can always be treated locally. If potential uses are found, transportation becomes the problem. I started thinking about how existing industry could be utilized in local food production and how food could be produced sustainably", says Henri Laine.

Laine decided to act and searched online for ways to get support in developing his idea. That's when he came across the Pilot Programme for Nutrient Recycling, which provides support to SMEs promoting nutrient recycling. He contacted the ELY Centre, and that marked the beginning of both his first project and his company, Redono Oy.

Utilizing Industrial Side Streams

In a feasibility study carried out in 2017–2018, the newly founded company developed a container-scale BioFeed unit that produces liquid fertilizer from industrial side streams. The project showed that the concept could be applied to side streams from breweries, biogas plants, and recirculating aquaculture systems.

"The BioFeed treatment process we developed for industrial side streams is now a patented method."

In 2024, the company is working with its partners to develop a broader, commercial-scale production environment – an ecosystem for local urban food production – at Rosk'n Roll's Munkkaa waste management center in Lohja. The site also hosts Gasum's biogas plant, which produces biogas and recycled fertilizers from biowaste collected in Uusimaa.

"The goal of the PURE feasibility study project is to create at Munkkaa a business ecosystem that serves multiple actors, where nutrients are recycled locally, and local food is produced year-round. In the future, the concept can be scaled to other regions and international markets", Laine says.

Redono's BioFeed processing plant would refine fertilizers produced by the biogas facility into nutrient products suitable for indoor farming technologies, with an annual capacity of 10,000 cubic meters. The recycled nutrients would be used locally to produce microalgae, Arctic herbs, gourmet and medicinal mushrooms, hops, and other food crops.



Illustration of the planned PURE production environment at Rosk'n Roll Oy's waste station in Munkkaa, Lohja. The BioFeed plant would process 10,000 tons of recycled fertilizer annually, which would be utilized in food crop production. The facility complex would also include processing, treatment, storage, and logistics centers.

Cultivation trials have included e.g. growing Lapland nettles in collaboration with Arctic Warriors Oy, as well as other edible plants and sprouts. With recycled fertilizers, microalgae have also been successfully cultivated together with the HAMK Bio research unit. Metropolia University of Applied Sciences has also participated in the cultivation trials.

Collaboration as the Cornerstone

Redono has advanced its idea through several different projects. In addition to the Pilot Programme for Nutrient Recycling, the company has received support from Business Finland and Sitra.

"The projects have been important milestones for the development of our company and have provided a platform for collaboration between multiple stakeholders. State support has enabled us to secure sufficient resources to carry out the projects as planned and efficiently", says Laine.

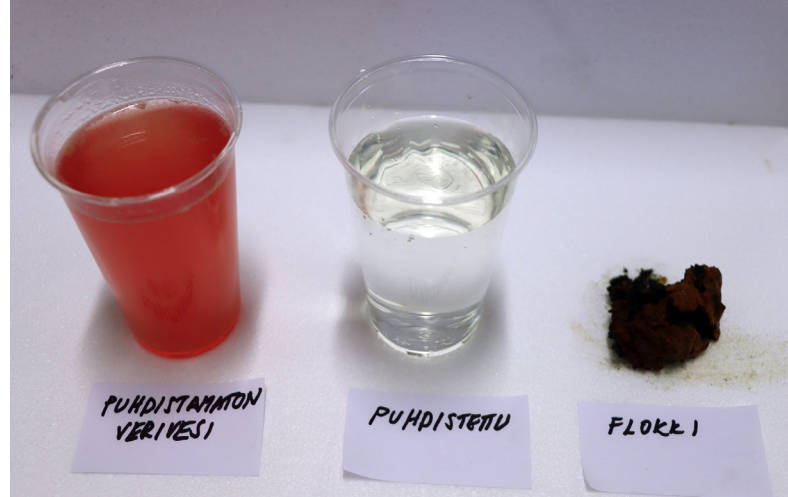
After the PURE project, Redono intends to take a step closer to practice by continuing planning work, including mapping out investment needs.



Nettle cultivation in Lapland.



Sirkku Rönkä, CEO of Flocon Technologies Oy, and Mikael Åbacka, Chairman of the Board, in Kaskinen.



The cleaning process of fish processing wash water illustrated. Solids and nutrients bind to the floc.

Fertilizer from Fish Industry Wastewater

The Espoo-based company Flocon Technologies Oy utilizes wastewater with its electrochemical water purification method, which separates impurities or nutrients from the water. The company is expanding the method in its product development project to cover fish industry waters.

"No sludge is generated in the process. The nutrients remain in the floc, which can be used as fertilizer", explains the company's CEO, **Sirkku Rönkä**.

Flocon's goal is to develop a process that enables biomass to be utilized locally for fertilizer production instead of being transported elsewhere as wastewater. The project was carried out from June 1, 2023, to August 31, 2024.

For the project, a prototype was built and test runs were carried out on fish processing wash water at the facilities of Hamnskärs Lax in Kaskinen. The test equipment's energy consumption is about 2 kilowatt-hours per cubic meter of blood water.

Tests have shown that the water can be purified to a level where it can be released into nature after the treatment process.

"We are also able to create a process where ammonium nitrogen remains in the water while all phosphorus is separated in the floc."

"The water can then be spread on fields, for example in areas where phosphorus amounts are already above limits", says Chairman of the Board, **Mikael Åbacka**.

Flocon intends to present the project results to fish processing plants and the meat production industry. The fertilizer quality of the floc will be analyzed together with fertilizer manufacturers and experts.



Watch the video on YouTube!

Technology Also Tested on Pig Slurry

The project builds on the company's earlier research and development work. In 2018, the Pilot Programme for Nutrient Recycling funded a project in which the company tested the separation of nutrients from pig slurry.

The results showed that phosphorus could be recovered very efficiently from pig slurry, while nitrogen recovery was only 30–50 percent. By enhancing the pre-treatment, nitrogen can also be removed more effectively.

"The support from the Pilot Programme for Nutrient Recycling has enabled product development work for a small company."

Weeefiner Captures Nutrients from Fish Farming Tanks

Nutrients from fish feed and excrement can be harmful to fish in recirculating aquaculture systems, but they also serve as raw materials for recycled fertilizers.

Weeefiner Oy has developed the 4D Scavenger technology, which can capture dissolved materials such as metals and nutrients from different types of water. Potential applications include process and mining industries, metal refining, and stormwater and wastewater treatment.

“We already knew that our scavenger could capture not only metals but also nutrients. The idea for this project came when we learned that dissolved nutrients in aquaculture waters are a problem. They’re hard to remove and even harder to reuse”, says Project Manager **Saara Tuhkanen**.

“With our technology, we can produce a nutrient concentrate from water, which can then be used in other industries, such as recycled fertilizers”, adds project chemist **Iida Kortelahti**.

Capturing 100,000 kg of Nitrogen per Fish Farm Annually

In Weeefiner’s process, water is pumped through the scavenger, and dissolved materials attach to a 3D-printed porous filter. The materials can then be returned to the process or refined for other uses.

In its nutrient recycling project, the company has tested scavenger reactors and developed nutrient



Weeefiner’s Development Manager Saara Tuhkanen (left) and chemist Iida Kortelahti presenting the 4D Scavenger technology. Nutrients attach to 3D-printed porous filters.

recovery in laboratory tests. Based on the results, larger-scale tests were carried out at the Natural Resources Institute Finland’s (LUKE) fish farm in Laukaa.

According to Weeefiner’s calculations, a full-scale recirculating aquaculture system could capture up to 100,000 kilos of nitrate nitrogen in a year.

More Nutrient Projects Ahead

Tuhkanen and Kortelahti note that the project would not have been possible without funding from the Pilot Programme for Nutrient Recycling.

“After the project, we have a more complete product that will be useful for many customers”, says Saara Tuhkanen. She emphasizes that customer demand for nutrient recovery is growing. Weeefiner will definitely carry out more nutrient projects in the future.

The project “Recycled Fertilizer from Recirculating Aquaculture – Recovery of Nitrate, Phosphate, and Potassium from Fish Farm Waters” was implemented from January 1, 2023, to June 30, 2024.



Watch the video
YouTube

An aerial photograph showing a tractor in a large agricultural field, applying a reddish-brown material (soil improvement fibers) in a straight line. The field is divided into green and brown sections by the application. The tractor is moving away from the viewer, leaving a trail of the reddish-brown material behind it.

Soilfood's Soil Improvement Fibers Keep Nutrients in the Field

Fiber treatment in October 2021. Photo: Creative Crue

Soilfood Oy has been studying the benefits of using soil improvement fibers for farmers, the environment, and society as a whole together with the Natural Resources Institute Finland (LUKE) and corporate partners. The research has expanded from test plots to catchment area-level studies and continues in the Archipelago Sea region, which is critical for nutrient runoff.

In the Finnish forest industry, around 600,000 tons of side streams are generated annually, which instead of being incinerated, could be used as soil improvers in agriculture. Soilfood has been researching the use of soil improvement fibers in crop production for several years.

"Around 2014, the research and development needs of the forest industry and agriculture met in a joint project

between LUKE and forest industry companies. The idea emerged that soil improvement fibers could enhance the soil structure of clay fields, reduce erosion, and decrease nutrient leaching from clay soils", explains Project Manager **Eetu Virtanen** from Soilfood.

The first long-term field trials with soil improvement fiber treatments were carried out in 2015 and repeated in 2020. The trials have been conducted by LUKE at its Jokioinen research field.

"The results of the first field trial were extremely promising, creating the need to collect more research data on the effects of these products."

Phosphorus Runoff from Clay Soils Cut in Half

Soilfood has received funding from the Pilot Programme for Nutrient Recycling for several research projects on soil improvement fibers. The "Soil Improvement Fibers 2" project monitors the environmental and crop production impacts of repeated soil fiber treatments and compares the results with those of earlier applications. The study found that after the new treatment, the soil structure

of the fields improved further.

According to Virtanen, in the past eight years a wealth of new research data has been produced on soil improvement fibers, including their effects on soil microbiology, soil organisms, and nutrient retention capacity.

"Soil improvement fibers are an effective water protection measure for agriculture. They can cut erosion and phosphorus runoff from clay soils in half, and their impact remains strong for about five years after treatment", Virtanen summarizes the key findings.

Virtanen states that the use of soil improvement fibers has increased in Finland, and they are currently applied on about 3,000 hectares of farmland. Soilfood's goal is to further expand the soil fiber market in Finland and across Europe.

Expanding Research to Catchment Areas

Research has been extended to the catchment scale in projects funded by the Ministry of the Environment. In the Savijoki catchment, which is part of the Archipelago Sea basin, a trial is being prepared in which local farmers can choose soil treatments according to their fields' needs: gypsum, structural lime, or soil improvement fibers. The project is led by LUKE and implemented together with the Centre for Economic Development, Transport and the Environment for Southwest Finland and the Finnish Environment Institute (SYKE).

Prime Minister Orpo's Government Programme includes an extension of the range of soil improvers beyond gypsum to also cover structural liming and soil improvement fibers.

"We believe that when all three proven methods are available to farmers, a greater impact will be achieved, especially in the Archipelago Sea catchment area, where it is urgent to reduce phosphorus runoff and keep phosphorus in the soil available for plants", Virtanen says.

"A unique community has formed around the trial work."



Project Funding Plays a Key Role

Virtanen notes that funding from the Pilot Programme for Nutrient Recycling has been crucial.

"Our company would not have been able to carry out high-quality, long-term research without the projects financed by the Pilot Programme for Nutrient Recycling. In addition, our business and research partners have formed a unique community around the trial work."

Soilfood's projects have been supported by Metsä Group, Stora Enso, Biolan, and the Confederation of European Paper Industries (CEPI).

Soilfood has received funding from the Pilot Programme for Nutrient Recycling for four research and development projects, as well as for investments in soil improvement processing and refining facilities.

Watch the video on YouTube!



Potato Production Side Streams as Fertilizers

Thousands of tons of energy- and nutrient-rich side streams, such as potato peel mass, are generated each year in the production of Pohjolan Peruna, best known for its *Mummon* products. The company has been seeking solutions for utilizing these side streams in several projects.

Between 2016 and 2018, Pohjolan Peruna, together with the Natural Resources Institute Finland (LUKE), investigated the biogas potential of potato production side streams. Local farmers also conducted fertilizer trials.

"We came to the conclusion that it makes sense to extract biogas from potatoes. The nutrients remain in the digestate and can be used in crop cultivation", says **Erkki Pisilä**, Factory Manager at Pohjolan Peruna.

A biogas plant is now being built next to the factory to process the side streams. Biogas will replace the factory's fuel oil, and the digestate (reject) generated in the process will be available for use by nearby farmers – including those in organic farming.

Positive Experiences from Farmers

The first project was followed by the "Luomu Ralta" project, where fertilizer trials with side streams continued on local

farmers' fields.

"We found that the fertilizer works well as a nutrient source for fields. Farmers had positive experiences especially in oat cultivation, because yields improved and the stalks grew stronger. The fertilizer also boosted the soil's microbiological activity", explains **Jarkko Ojala**, CEO of Pohjolan Peruna Oy.

The project also examined how nutrients from the side fractions could be utilized in substrates and in decommissioned peatlands for fertilizing bioenergy crops.

The substrate study showed that using digestate in substrate production would have required a larger-scale biogas plant. For bioenergy crops on decommissioned peatlands, no cost-effective fertilization solution was found due to logistical reasons. In addition, some energy crops are not suitable for heating boilers.

Reject Is Stored Close to the Fields

The third project, "Luomu Alka", has focused on the refinement, logistics, and commercialization of digestate. Pohjolan Peruna has identified interested farmers, and nutrient value analyses of the side streams have been carried out to support them. The project also explores enriching the digestate with additional nutrients to make the final product as beneficial as possible for farmers.

"Regarding storage, we studied whether it makes sense to store digestate centrally or in a decentralized way. For cost-efficiency, we opted for a decentralized model, so that the tanks can be placed close to the fields where the digestate will be spread", says Jarkko Ojala.



French fries on Pohjolan Peruna's production line.

Pohjolan Peruna's Factory Manager Erkki Pisilä. In the background, the biogas plant under construction in November 2023, which will replace about 600,000 liters of fuel oil per year at the factory.



Watch the
video on
YouTube!

Better Self-Sufficiency and Competitiveness

According to Ojala, Pohjolan Peruna is aiming for business operations that take the environment and circular economy into account, and this goal has progressed through a series of successive projects. He notes that the funding from the Pilot Programme for Nutrient Recycling has played a significant role in carrying out the projects.

"A business perspective is always present in the projects. They have increased our competitiveness in the energy sector and strengthened regional self-sufficiency in agriculture", summarizes Erkki Pisilä.

Pohjolan Peruna has received funding from the Pilot Programme for Nutrient Recycling for three research and development projects between 2018 and 2024.



Autumn application of potato starch slurry with an incorporating disc spreader in the "Luomu Ralta" project, carried out in 2020–2022. Photo: Pohjolan Peruna

Cultivating Mushrooms Through Circular Economy

Helsieni Oy grows mushrooms on substrates made from recycled materials and has significantly developed its operations with the support of the Pilot Programme for Nutrient Recycling. The company is developing new substrate recipes that make use of e.g. hemp shives and common reed. Its goal is also to increase growing space and expand the use of its recipes.

Stéphane Poirié and Chris Holtslag combined their interests into a joint company, Helsieni Oy, in 2016.

Poirié wanted to grow vegetables or other edible products, while Holtslag was interested in doing something within the circular economy. Holtslag had read that in his home country, the Netherlands, mushrooms were successfully grown on coffee grounds.

"We went to the Netherlands to learn and gradually developed our own products. From the very beginning, we have also trained people to grow mushrooms themselves", says Stéphane Poirié.

Today, Helsieni produces 3,000 kilos of oyster mushrooms, 200 kilos of lion's mane, and 200 kilos of shiitake mushrooms annually. In line with circular economy principles, the mushrooms grow on a substrate that contains as many recycled materials as possible.

Business Kick-Started with Funding

Helsieni has developed its operations and tested



Stéphane Poirié is one of the founders of Helsieni Oy.

different substrate materials in two projects funded by the Pilot Programme for Nutrient Recycling.

"We received support to start the mushroom business in 2018. Our main goal was to combine business with the circular economy. In the second project, we are focusing on developing the substrate and expanding the business", Poirié explains.

According to Poirié, the first development project had a major impact on the company's operations: after the project, turnover doubled. In addition, the company's energy consumption decreased by 80 percent.

Testing New Raw Materials for Substrates

Until now, Helsieni's substrate recipe has consisted of straw pellets and coffee grounds collected from restaurants. Now, the company is testing, comparing, and developing new raw materials for mushroom substrates to be used in the Nordic countries. The focus is on natural resources considered waste or sources of environmental problems.

The company has experimented with using hemp and flax shives, birch and alder sawdust, sunflower husks, and common reed as substrate materials.

"So far, the most significant result has been the inclusion of hemp shives in the recipe. It improved the overall productivity of the substrate by 20 percent. Common reed also has great potential, especially summer reed, which is very nitrogen-rich", Poirié explains.

Development Work Continues

Helsieni plans to continue further development once the project is completed. The aim is to improve both the process and the substrate recipe, which will also be tested for growing other mushroom species on different mushroom farms. The company has several partners in Finland and across Europe who can make use of this recipe.

"We also intend to acquire more growing space. However, production will only be increased in line with demand, so that space is not acquired unnecessarily. For example, demand for oyster mushrooms is currently growing by a few percent each year."



Watch the video on
YouTube!

Helsieni grows oyster mushrooms and other edible mushrooms in shipping containers. The company operates in Karjaa and Helsinki.



**"Farms should try recycled fertilizers
more boldly"**



Niko Ranta has been using
recycled fertilizers on his
farm since 2015.

The long-term use of recycled fertilizers keeps the fields in good condition, says farmer Niko Ranta.

Niko Ranta and Johanna Nurmela-Ranta run a crop farm in Ikkeläjärvi, Kauhajoki, now in its ninth generation. On their 175 hectares of cultivated land, they mainly grow barley, but also wheat, rapeseed, and peas. Most of the harvest is sold to local industry, with some going directly to farms.

“Even though we farm part-time, we continuously strive to develop the farm’s operations”, says Niko Ranta.

The farm has been using recycled fertilizers since 2015. Slurry-based recycled fertilizer from a biogas plant has been delivered to the farm from Honkajoki by Soilfood and Kiertoravinne Oy. Over the years, they have also received some manure slurry from nearby cattle farms. The slurry is stored in the farm’s four slurry tanks.

Ranta has observed that the long-term use of recycled fertilizers has improved the condition of the fields.

“Recycled fertilizer is diverse, as it contains more than just NPK. Other advantages are its affordable price and consistent quality”, Ranta explains.

Light Tillage Proves Effective

Currently, recycled fertilizers are applied annually to 40–50 hectares of the farm. The slurry is spread in the spring and immediately incorporated into the soil, which Ranta says has proven to be the most effective method. Autumn fertilization is used less often, mostly under rye.

“Fertilizer limits are tighter in the autumn. In the spring, you need patience so you don’t spread on soil that’s too wet. At first, it took practice to find the right timing. We gradually found a method that works.”



“The price of artificial fertilizer is certainly not going down. Therefore, we aim to increase the use of slurry from different sources.”

It is possible to receive an agri-environmental subsidy for applying organic fertilizer with incorporation equipment, which covers part of the spreading costs.

Goal to Reduce Bagged Fertilizers

Ranta believes that as long as the price remains low, recycled fertilizers are a profitable option. In the future, the couple plans to reduce their use of bagged fertilizers.

“We’re trying to find a partner farm so we could also use livestock manure. The price of artificial fertilizer is certainly not going down. Therefore, we aim to increase the use of slurry from different sources.”

Ranta thinks the agricultural support system should be developed to encourage farms to make greater use of recycled fertilizers.

“On the other hand, farms themselves should be bolder in trying them out. Even a small farm can benefit from using recycled fertilizers”, he concludes.

Development in the Field of Nutrient Recycling

According to an impact assessment commissioned by the Pilot Programme for Nutrient Recycling, the funding-enabled experiments have advanced the sector. Without this support, many projects would not have been realized.

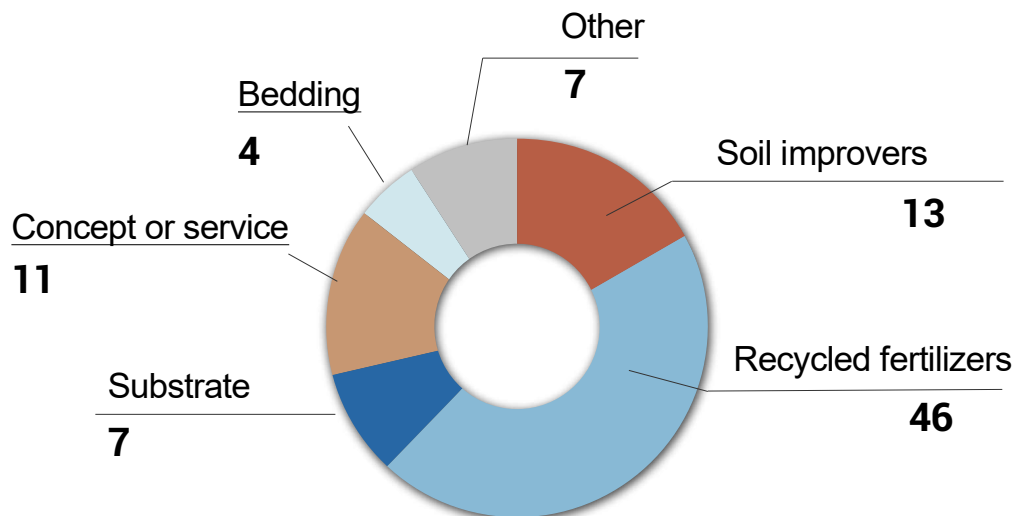
The impact study, carried out by the Natural Resources Institute Finland (LUKE), shows that the nutrient recycling sector in Finland has developed during the implementation of the pilot programme. This is particularly evident in how funding has been allocated. In the first programme period (2016–2018), the focus was on small-scale, high-risk experiments, whereas in the later programme period, starting from 2020, the emphasis has shifted to larger-scale research, the development of existing operations, and investments.

With the programme's support, companies have developed recycled fertilizers and soil improvement products from various biomasses using different methods.

In addition to traditional techniques such as anaerobic digestion and composting, methods like pyrolysis and membrane filtration have also been used to separate nutrients from biomass. The most common raw materials in the projects have been livestock manure, digestate from biogas plants, biowaste, and side streams from the food industry.

Projects have also focused on developing substitutes for peat in growing media and bedding materials, as well as services that support nutrient recycling.

“Funding has made it possible to carry out experiments that companies would not otherwise have had the resources for. Even the unsuccessful experiments are



These end products were the most sought after in the pilot programme's projects. The figure includes projects completed by spring 2024.

"Funding has made it possible to carry out experiments that companies would not otherwise have had the resources for. Even the unsuccessful experiments are valuable, as they guide the sector's development in the right direction."

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valuable, as they guide the sector's development in the right direction", says **Sari Luostarinen**, Senior Specialist at LUKE, who carried out the impact assessment.

Respondents to a survey sent to project operators considered public support to have been of great importance to project implementation, and the experiments would not have taken place without the pilot programme's funding.

Continued Funding Ensures Progress

Although the pilot programme has significantly advanced nutrient recycling, solutions related to the use of recycled fertilizer products (such as fertilization effect, logistics, and application methods) would have required more attention, according to the assessment.

The report recommends continuing funding similar to that of the pilot programme so that the practical progress already made in nutrient recycling does not come to a halt due to a lack of long-term support.

It is also recommended that thematic project funding continue in identified areas. Communication and knowledge transfer needs in particular were highlighted in the assessment. There is already a wealth of existing knowledge on nutrient recycling, which should be shared more effectively for the use of companies, advisory services, and education, instead of the current fragmented offering.

The full impact assessment can be read in the Doria publication archive at www.doria.fi/ely-keskus.



Facade of Biolan's biofiber plant. Photo: Biolan Oy

Biolan Invests in a Unique Biofiber Plant

In February 2023, Biolan celebrated the opening of a biofiber plant in Eura: a facility considered unique even on a global scale. With this investment, Biolan is accelerating the reduction of peat use in its growing media and bedding products. The investment was preceded by extensive research and development work to study and identify a suitable process.

The plant uses by-products from the forest industry and wetland biomass as raw materials. In the process, wood chips are converted into wood pulp, which, together with wetland biomass, is used to produce growing media and bedding.

The investment received support of around EUR 2.6 million from the Pilot Programme for Nutrient Recycling, covering about 45 percent of the budgeted costs.

The programme has also funded Biolan's "Growth with Agricultural Organic Side Streams" research and development project, carried out between 2017 and 2019.

Since 2016, the nationwide Pilot Programme for Nutrient Recycling has funded research, development, and innovation projects as well as investments by small and medium-sized enterprises that promote nutrient recycling for the benefit of agriculture.

The funding for the pilot programme is granted by the Ministry of Agriculture and Forestry. The programme is administered by the Centre for Economic Development, Transport and the Environment for South Ostrobothnia.



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