Luke
NATURAL RESOURCES
INSTITUTE FINLAND

Plant bioprotection in the Nordics
– Luke's insights for research

World biopesticides markets are under heavy pressure, caused by a rapidly changing global operational environment, including climate, energy, and food crises. Novel, resource efficient biobased solutions are urgently needed. At Natural Resources Institute Finland (Luke), we work closely with frontrunner industry partners to co-develop new bioprotection solutions, concepts, and innovations.

Examples of Luke's recent research on bioprotection

1. CASE – PERFORMANCE OF BIOPESTIDICES DERIVED FROM BIOMASS THERMOCHEMICAL CONVERSION

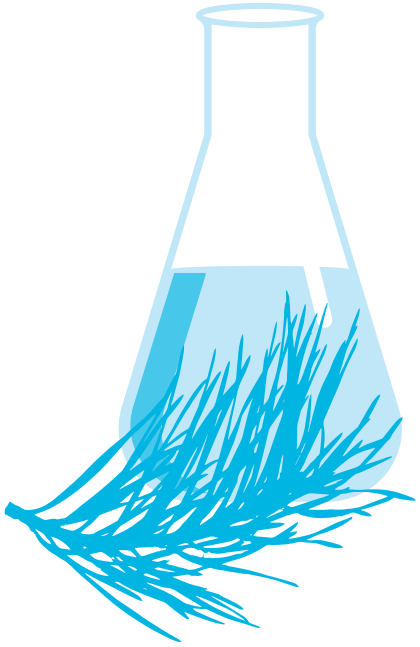
Luke's research team has strong expertise in the research of thermochemical biomass conversion technologies. These flexible technologies are used to fractionate biomass to products that are suitable for value-added applications. For example, we have developed and tested liquids from slow pyrolysis, torrefaction, and hydrothermal carbonization (HTC) in plant protection applications. As a result, several publications and one patent has been published. Currently one patent is in pending and future work is aimed to cascading the use of biomass to use biomass resources more efficiently.

More information: doi.org/10.1007/s12649-018-00545-1 and doi.org/10.3389/fchem.2021.821806

2. CASE LIQUID MULCH – LUKE'S NEW BUSINESS OPPORTUNITY FOR BIOBASED SOLUTIONS

This novel technology, based on wood or plant originating materials (peat, water, pyrolysis liquid and additives such as biochar), decreases the use of pesticides and plastic mulches in horticulture and landscape management. It ensures good control of weeds and growth of cultivated plants. No plastic or chemical residues remain in the soil. Plant based materials of the mulch increase the organic matter content and fertility of soils.

More information: luke.fi/en/services/liquid-biodegradeable-mulching-technology-for-weed-management



3. CASE – ENHANCING SOIL SUPPRESSIVENESS AGAINST POTATO COMMON SCAB

Potato common scab caused by several *Streptomyces* spp. is a harmful potato disease with no effective methods of control. *Streptomyces* spp. strain 272 was isolated from a potato tuber in Finland and was verified nonpathogenic in laboratory assays. In a long-term field trial over 5 years a repetitive use of the strain reduced the severity of common scab by over 50 % on average.

More information: doi.org/10.1094/PDIS-07-16-1020-RE

4. LUKE'S RESEARCH COLLABORATIONS PROVIDE HIGH CLASS PARTNERSHIP OPPORTUNITIES:

a. R&D collaboration and piloting opportunities

b. Non-exclusive licensing of IPR and know-how for company partners

c. Testing and development support

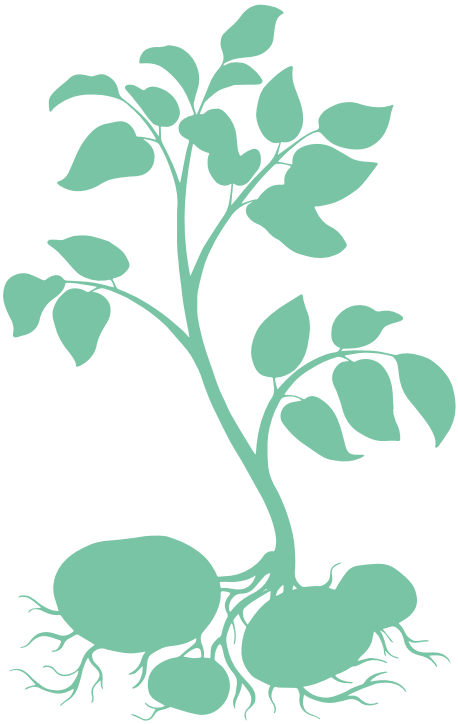
Efficacy testing of biopesticides according to Good Experimental Practice (GEP)

Since 1998, Luke has tested the efficacy of pesticides according to Good Experimental Practice (GEP) for major international pesticide companies. Our customers value our expertise and our range of possibilities to do field trials on most European field crops to control most common pests. Biopesticides are sensitive to weather conditions. We provide the most Northern agricultural conditions in Europe with short, intense growing seasons and a lot of daylight.

Product development studies

Luke's expertise can be used in various stages of the biopesticide development process. We can test susceptibility and dose-response on target organisms, study adverse effects on non-target organisms and the degradation of substances in soil in our modern laboratories and greenhouses.

In addition, we can study the usability and efficacy of other biocontrol agents, e.g. pest predators and parasitoids, both in field and in greenhouse conditions. We have the necessary expertise for studying various types of biostimulants in plants and in soil.



Cropping systems and IPM

Luke has extensive expertise of agri- and horticultural cropping systems and Integrated Pest Management. Field trials can be conducted in Jokioinen in Luke's own 800 ha field area, or in the fields of our wide network of farmers and other cooperators.

Expert services and research projects

We know the European registration processes and requirements for pesticides and biopesticides and can provide such expertise to our customers. We can also provide literature and pilot studies on various subjects and expert evaluations of R&D data.

Natural Resources Institute Finland (Luke) is Finland's second largest government research institute. We perform and participate in research projects and provide expert services to advance the bioeconomy and sustainable use of natural resources. We are currently participating in ~715 ongoing projects, of which 124 are EU-funded.

Publications

Hagner, M., Tiilikkala, K., Lindqvist, I., Niemelä, K., Wikberg, H., Källi, A., Rasa, K. 2020. Performance of liquids from slow pyrolysis and hydrothermal carbonization in plant protection. Waste and Biomass Valorization 11:1005-1016 doi.org/10.1007/s12649-018-00545-1

Hagner, M., Hyvönen, T., Mikola, J., Kemppainen, R., Lindqvist, B., Suojala-Ahlfors, Tiilikkala, K. 2020. Efficiency of a novel biodegradable pyrolysis liquid-amended mulch in weed control. Weed Research 60:182-193 doi.org/10.1111/wre.12411

Hiltunen, L., Kelloniemi, J. Valkonen, J.P.T. 2017. Repeated applications of a nonpathogenic *Streptomyces* strain enhance development of suppressiveness to potato common scab. Plant Disease 101:224-232 doi.org/10.1094/PDIS-07-16-1020-RE

Korkalo, P., Hagner M., Jänis, J., Mäkinen, M., Kaseva, J., Lassi, U., Rasa K., Jyske T. 2022. Pyroligneous acids of differently pretreated hybrid aspen biomass: herbicide and fungicide performance. Frontiers in Chemistry 9:821806 doi.org/10.3389/fchem.2021.821806

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