

Valorising European Research for Innovation in Agriculture and Forestry



VALERIE Stakeholder Trials:

Demonstrating the use of wood ash as a forest fertilizer on mineral forest soils in the Joensuu area, Finland

The problem

Wood ash is a waste product from biomass power stations in Finland. There is a need to understand the potential value of wood ash as a forest fertilizer, and so contribute to the goals of a circular economy in Finland. The volume of ash is increasing all the time and recycling it is expensive. There is a lack of information about wood ash use for the growing number of people involved in small energy and heat plants. Use of wood ash fertilizer presents a potentially economically viable solution to address problems with nutrient poor forest soils and associated declines in tree growth. Wood ash fertilizer is already used effectively on peat forest soils in Finland but little is known about the impacts of using it on mineral forest soils.

The proposed solution

The target of this 'trial' is to demonstrate wood ash fertilization in forests on nutrient-poor mineral soil. Under current forest management, the stands are harvested by logging and the nutrients are removed from the site. Using the wood ash offers a chance to return nutrients to the soil as has already been demonstrated in peat soils. Other recycling options such as road construction were also discussed and demonstrated but are not reported here.

Stakeholders

TAPIO working with the Valerie project has brought together forest owners and managers, ash producers (e.g. community energy cooperatives), ash processors and operators, researchers, developers, energy providers and policy-makers to identify innovations in forestry practice in Finland. These stakeholders identified the potential for wood ash to be used as a fertilizer on mineral forest soil. In the Joensuu area the share of bioenergy in energy production is very high and there are plenty of organisations who are interested in wood ash recycling. Ecolan (an ash processor) has a long practical experience of wood ash analyses, forest fertilizers and other wood ash products making them one of the key stakeholders.

Aims and Method

As forestry trials take a long time to establish and provide results it was decided to show stakeholders existing research plots where wood ash is already being applied. This provided an opportunity to demonstrate existing trials and to collect information about the benefits, the barriers and the feasibility of using wood ash as a fertilizer.

Demonstration field trips were held with TAPIO organisers and some 20 stakeholders from a range of organisations in the Joensuu area to look at:

- Demonstration of the use of wood ash plus nitrogen fertilization on mineral soil at a pilot study site run by Ecolan
- A 40 year old wood ash fertilized peatland forest and a control stand without wood ash

During the field trip, stakeholders were also asked to complete a questionnaire about the barriers to wood ash use. In addition to the site visits there were expert presentations about the chemistry of wood ash and its effect on mineral soils, the influence of the wood ash on forest berries and mushrooms and forest biodiversity.

Results



Granulated wood ash fertilization samples with and without nitrogen

Demonstration of wood ash fertilization with nitrogen on the mineral soil.

Ecolan presented a new fertilizer where wood ash has been combined with nitrogen (urea from Yara) and granulated to make its spreading easier. In this established demonstration (with different treatments of wood ash), wood ash with nitrogen was used to fertilize the mineral soil forest. In total the fertilizer treatment consisted of 2700kg/ha wood ash with 300kg/ha nitrogen. Newly developed machinery was demonstrated for wood ash spreading in the mineral soil forest. Results from this formal trial were not yet available. The stakeholders were enthusiastic about the new product and saw the machinery, which was new to them, spread the ash easily. They also learned that the rainfall dissolved the wood ash quickly making it available for uptake by trees.



Wood ash spreading equipment mounted on a forwarder

Demonstration of a 40 year old wood ash fertilized peatland forest

The stakeholders visited an old wood ash fertilizer experiment on a drained peatland where they observed the positive influence of wood ash on peatland forest. The fertilization, which took place 40 years ago, increased growth of Scots pine trees and the financial performance of forest management has increased significantly compared to a control plot. The stakeholders were particularly interested in the obvious difference between fertilized and unfertilized stands and this stimulated discussion about the importance of old experimental stands.

The development of annual volume growth of Scots pine 1985–2010.

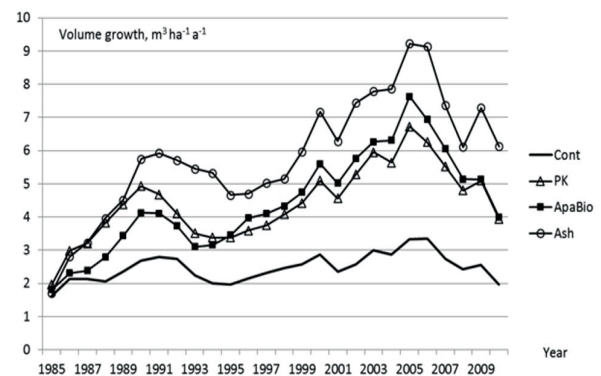
PK = PK for peatlands 600kg ha⁻¹,

Apa = Apatite 385kg ha⁻¹;

Bio = Biotite 1700kg ha⁻¹;

Ash = Wood ash 4500kg ha⁻¹, dust-like wood ash from a heating plant in Oulu city

(Moilanen et al., 2015)



The area fertilized by ash



The control area

The ash fertilization has compensated for the lack of phosphorus and potassium and increased the volume growth six times compared to the control.

Photos: Jorma Issakainen

Overall stakeholder involvement and feedback

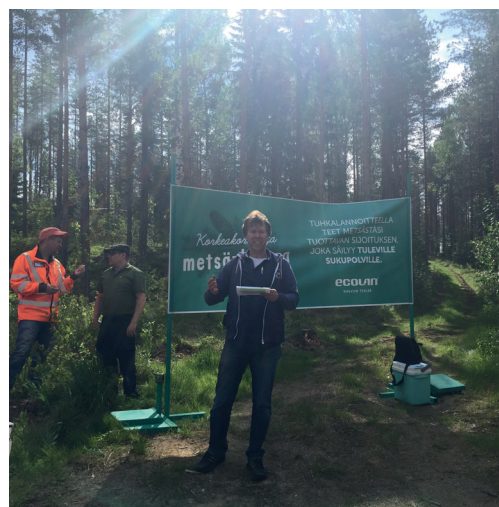
The demonstrations improved the stakeholders' awareness of using wood ash fertilization in forest mineral soils. They valued the opportunity to see demonstrations in the field, this helped to stimulate discussion and identify the stakeholders' expectations and opinions about wood ash fertilizer. In summary:

- Stakeholders strongly support ash fertilization because it offers a use for the waste product of the combustion process. It is a natural fertilizer and helps to restore the nutrient balance of forest soil after felling. For them the positive impact on soil fertility is that it lasts considerably longer than that of artificial fertilizers.
- The most significant obstacle to ash utilization seems to be the lack of knowledge about the beneficial effects (on soil nutrient content and tree growth) of wood ash fertilizer. The higher total cost of ash fertilization compared to artificial fertilization and the lack of operators offering ash fertilization were also mentioned as limitations.
- The main risks and challenges of ash fertilization (compared to the use of artificial fertilizers) according to the stakeholders are:
 - the product and its composition (e.g. N-content) are unknown,
 - the ash quality is important, any contamination with other wastes will negatively affect the quality of ash
 - demand and supply (ash production and granulation) do not necessarily coincide in the same area
 - the spreading of dry ash is especially difficult, and
 - there is a lot of regulation related to ash fertilization

When asked what should be done to remove the barriers, stakeholders agreed that improved information and practical education (work guidance, workshops etc.) showing the positive growth effects, and making the price competitive, are needed. In particular, they felt that policy makers and forest owners need to understand the value of wood ash, and regard it as a useful by-product rather than a waste product.

Key findings

- Stakeholders identified wood ash fertilizer use on mineral soils as a key innovation opportunity.
- Existing demonstration sites and trials provide evidence and practical insights of spreading of wood ash and its impact on yield.
- The barriers of using ash (include limited information, unknown quality, practical and institutional limitations) should be addressed through dissemination of information and awareness raising.



Further reading

Moilanen M., Hytönen J., Hökkä H., Ahtikoski A. (2015). Fertilization increased growth of Scots pine and financial performance of forest management in a drained peatland in Finland. *Silva Fennica* vol. 49: 3

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Wood ash



Stakeholder visit to a forest renewal site

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