Determination of the influence of liming with oilshale ashes to the changes of water extractable plant nutrients in acidic soils

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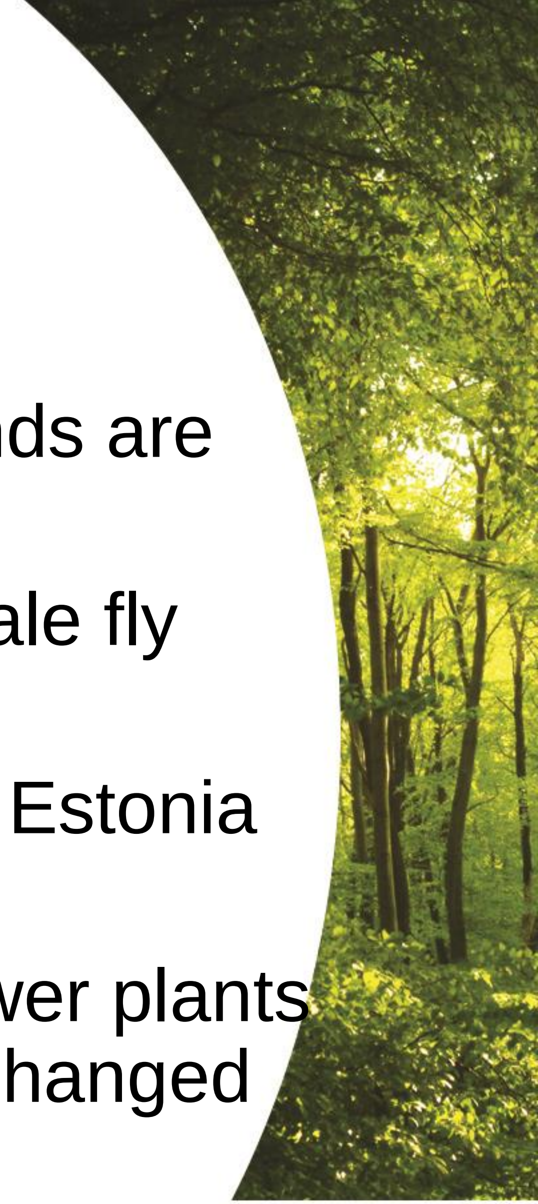
Introduction



- Approximately 50% of Estonian agriculturally used lands are acidic and need liming periodically
- In Estonian power plants appears 7,2 x 10^6 tons oilshale fly ashes as waste product annually
- The oilshale fly ashes has been used for soil liming in Estonia for several decades
- Due to using new modern burning technologies in power plants the fly ash chemical and physical characteristics are changed

Introduction

- Ashes used in the experiment came from company Eesti Energia which produces energy from oil shale. The main counterpoint comes from two different oil shale combustion technologies: pulverized firing (PF) and circulating fluidized-bed (CFB) technology. Besides that, they originated from different parts of boilers. The chemical and fractional composition of the ash depends on the fuel used, the combustion technology, and the part of the process from which the ash originates. Fly ash or dust shale ash is separated from the combustion gases by cyclones and filters

The aims of research

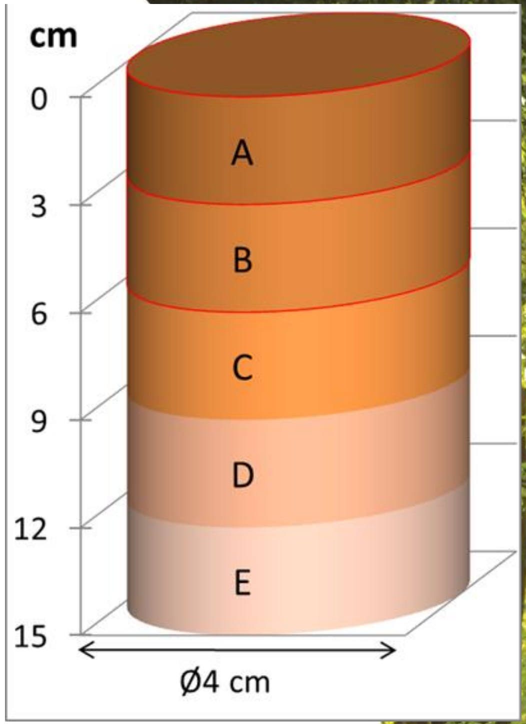
- To investigate the changes in content of water soluble P, K, Mg and Ca in soil after liming depending from type of used oilshale ash
- To estimate the mobility of added K, Mg and Ca with liming in soil

Materials and methods

- Pot experiment during 135 days
- 5 acidic soils, different by soil types from South –Estonia
- 6 different liming fertilizers (agents)
  - PF cyclon ash
  - PF filter fly ash,
  - CFB filter fly ash,
  - granulated PF filter fly ash,
  - granulated CFB filter fly ash,
  - milled limestone

Field	Soil pH	Texture
Siksala **(S)**	4,7	Coarse sand
Hummuli **(H)**	4,8	Medium sand
Väimela **(V)**	5,7	Medium sand
Madise **(M)**	5,3	Fine sand
Lutsu **(L)**	4,7	Coarse silt

Materials and methods



- For experiment plastic tubes (diam 4 cm) were used.
- 0,3 g liming fertilizers added on to surface of pot (2.4 tons per ha)
- Tubes were watered every week with 20 ml distilled water so I would be similar to Estonian yearly precipitation.
- In the end of experiment tubes were cut into different horizonts with height of 3 cm.
- For the experiment two upper horizonts were used.

Materials and methods

- Analysis
  - Water extractable P, K, Mg and Ca
  - pH_{KCl}
  - texture

Soils were divided into groups by pH and texture

pH:

group A soils with pH< 5.0,

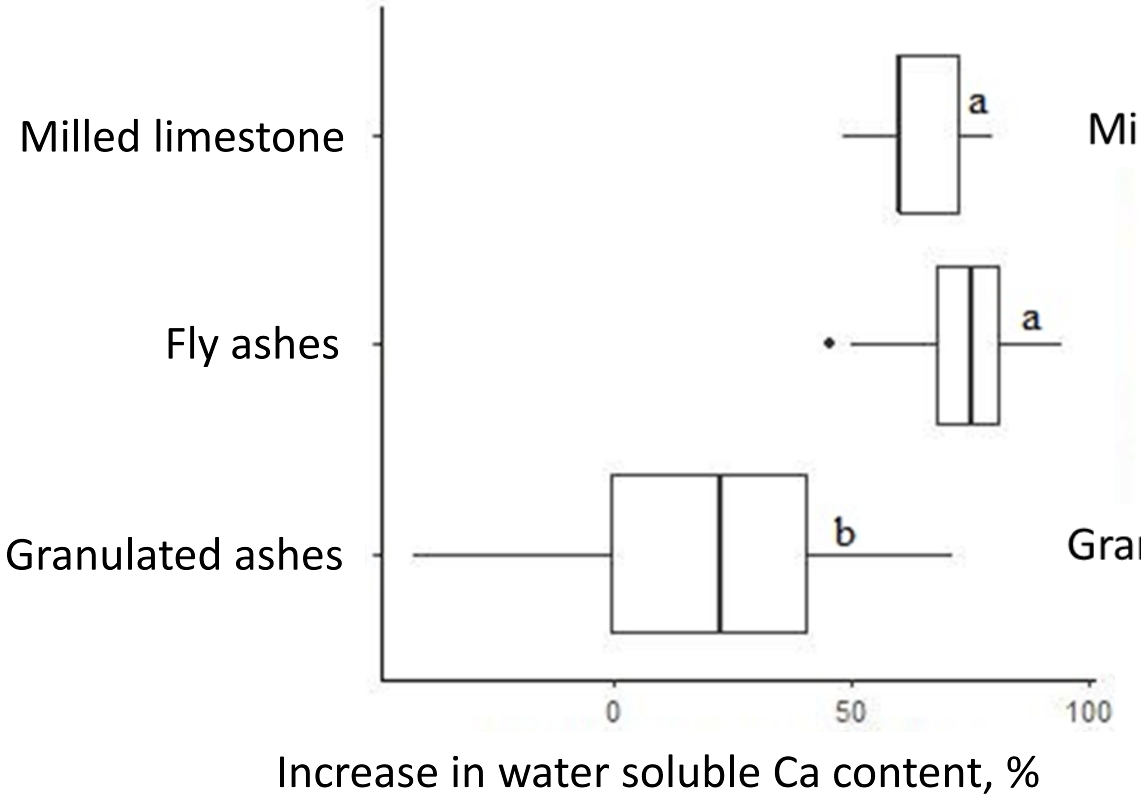
group B soils with pH>5.0

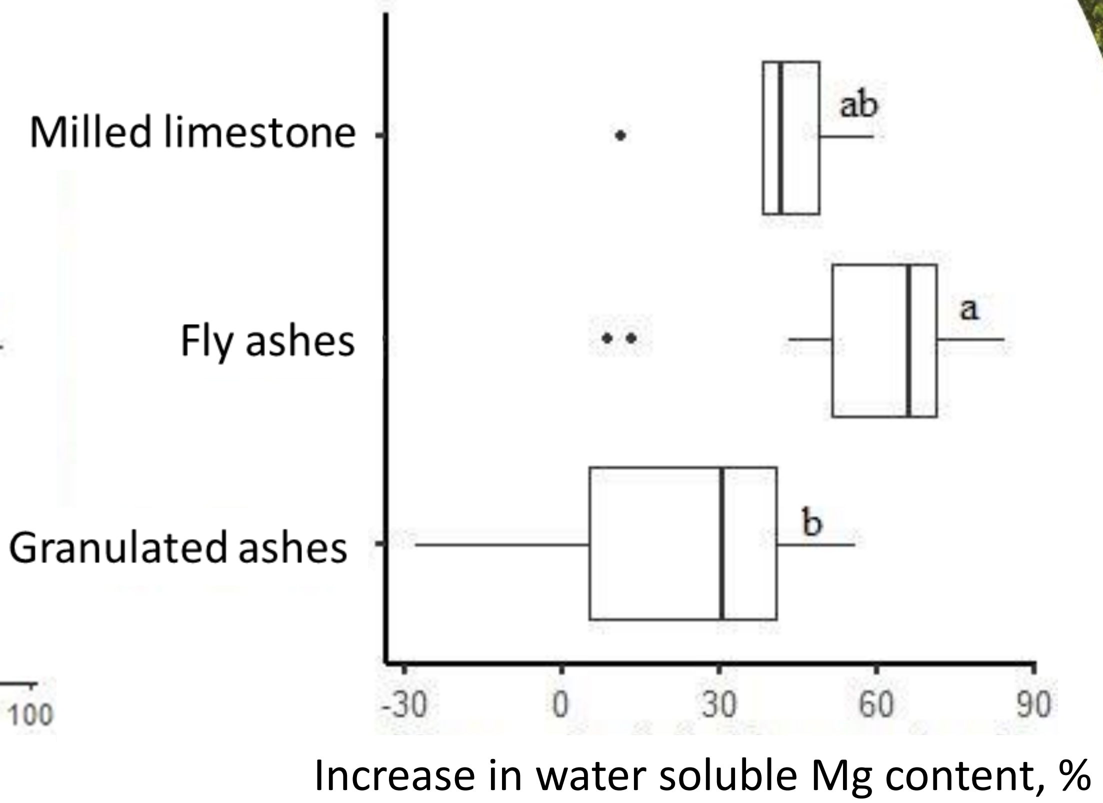
Texture:

group A - coarse and medium sand,

group B - fine sand and coarse silt

Results



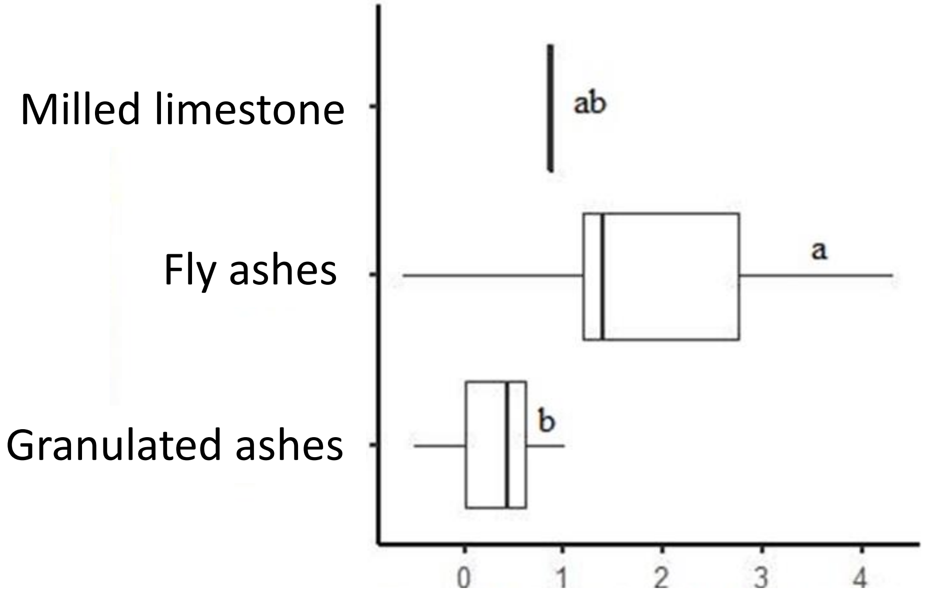


The greatest increase in soil water soluble Mg and Ca contents in upper 3 cm layer appears with using fly ashes (powder form) and the lowest grow is from granulated forms. In the B horizon (3 – 6 cm) there is no significant changes in water soluble Mg and Ca contents.

Results

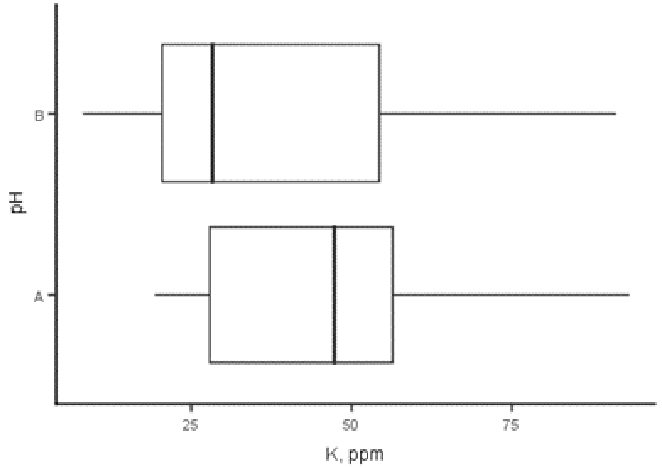
The mobility of water extractable nutrients in soil depends from the type of used liming fertilizer. The bigger difference between A and B horizons indicate higher mobility of nutrient element.

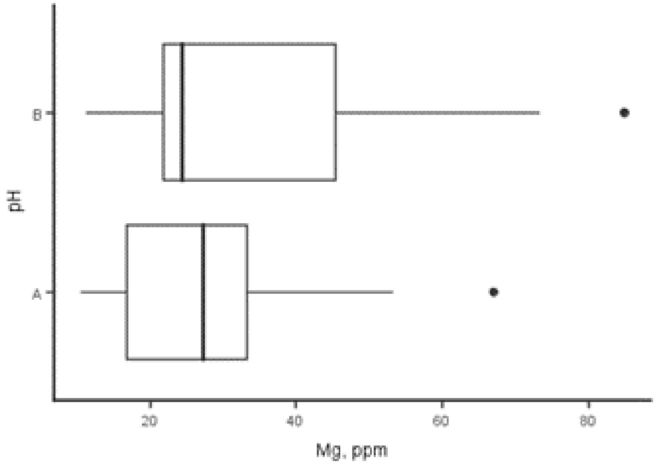
The mobility of Mg from fly ash is higher compared with granulated forms



The difference in water soluble Mg content between A and B horizons, mmol kg-1

Results



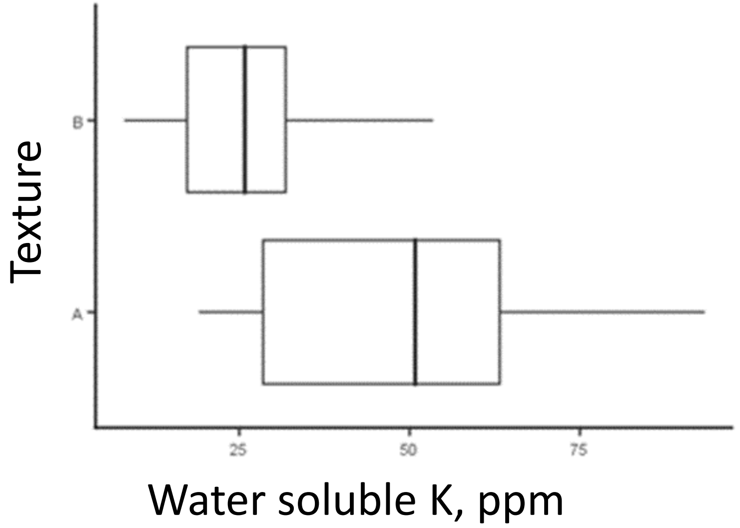


There is no observable differences in water soluble K, Mg and Ca contents between soil pH groups after 135 days incubation experiment

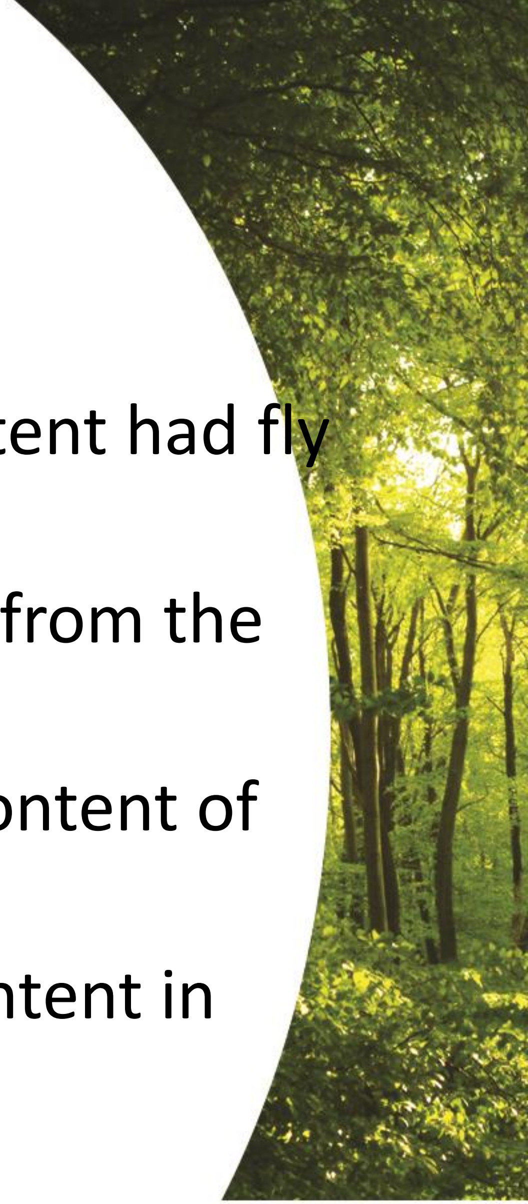
Results

The content of water soluble K depends from soil texture. The higher K content appears for soil texture group A after 135 days experiment.

For other elements the impact of texture was not significant



Conclusion



- The greatest impact to soil water soluble K, Mg and Ca content had fly ashes in powder form
- The mobility of water extractable nutrients in soil depends from the type of used liming fertilizer
- The pH of soil did not impact water soluble K, Mg and Ca content of limed soils.
- The texture of soil had an impact to the water soluble K content in limed soils