

## Filterbed material as a phosphate fertiliser

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## Introduction

- Filterbeds are expected to be effective in removing P from household waste waters for 10-15 years, after which the material has to be changed.
- *Hypothesis:* Used filter material can be applied to fields, where the crop is able to use (part of) the nutrients.
- Fertiliser effect differs between materials, depending of the degree of nutrient saturation.

## ... Introduction

- The effect of Filtralite P<sup>®</sup> on the growth and nutrient concentrations of grass was studied in two pot experiments (2003 and 2004).
- Filtralite P<sup>®</sup> was expected to be both a fertiliser source and liming agent.
- The materials were also characterised in laboratory experiments.

## Pot experiment 2003 / Materials and methods

- Fine sand, organic matter content 3.3%
- P concentration 3.6 mg/100 g soil (ammonium lactate method, P status "medium")
- 5-litre pots in a roofed cage
- Italian ryegrass, 3 cuts during 2.5 months

...Pot experiment 2003 /  
Materials and methods

- Plant nutrition treatments:
  - NK
  - NK + mineral P
  - NK + unused Filtralite P®
  - NK + mineral P + unused Filtralite P®
  - NK + used Filtralite P®, Bogstad (used for 3 years)
  - NK + used Filtralite P®, Norderås (used for 1 year)



Growth before a cut:

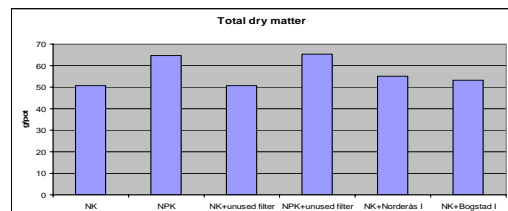
Results / P content of the materials

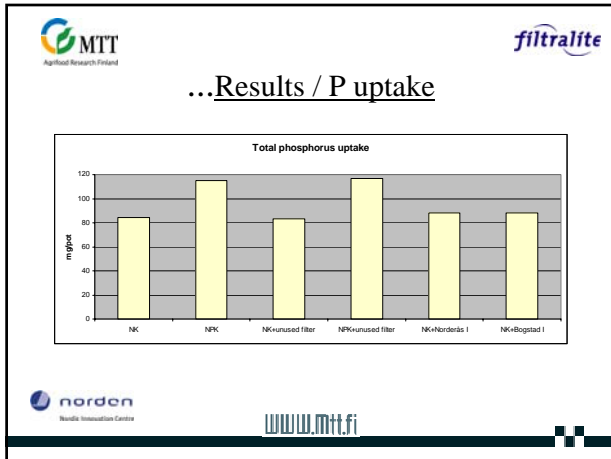
	<b>Norderås (1 yr)</b> <i>mg P / kg</i>	<b>Bogstad (3 yr)</b> <i>mg P / kg</i>
Total	2480	1230
NH <sub>4</sub> -lactate	47	113
Water-extr.	0.2	34

In these materials, used for a short time in filter beds, most of the total P was structural (native) P of the materials, and the level of easily soluble P was low.

Results / yield

- Used Filtralite P® increased yields slightly (5% - 9%), mineral P fertilising more (28 %).





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### Results / soil pH at the end

	Mineral P	Filtralite P <sup>®</sup>
<i>Acidic</i>	5.3	6.1
<i>Limed</i>	5.8	6.6
<i>Heav. limed</i>	6.6	7.1

-> Used Filtralite P<sup>®</sup> was a liming agent.

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- ### Conclusions
- Unused Filtralite P<sup>®</sup> did not have an impact on plant growth.
  - Used Filtralite P<sup>®</sup> did not have adverse effects on plant growth.
  - Fertilising value of Filtralite P<sup>®</sup> after 1-3 years of usage proved to be relatively small.
  - Total P content was not a good measure of plant-available P in used Filtralite P<sup>®</sup>.
  - The materials were effective liming agents corresponding to 15-30% of that of calcite limestone.
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- ### Pot experiment in 2004
- Filtralite P<sup>®</sup> was saturated with P in the lab at NLH/Ås (professor Tore Krogstad)
  - Total P concentration 9 000 mg P / kg, added P ca. 7 000 mg P / kg -> corresponds to material after very long use
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### P content of the material of 2004

	Original	Saturated with P
<b>Extractant</b>	<i>mg P / kg</i>	<i>mg P / kg</i>
Total (HF-extr)	1940	9030
NH <sub>4</sub> -lactate	63	4650
Water	0.2	69

**Filtralite P<sup>®</sup> has a very high P-binding capacity.**

### Pot experiment 2004 / Materials and methods

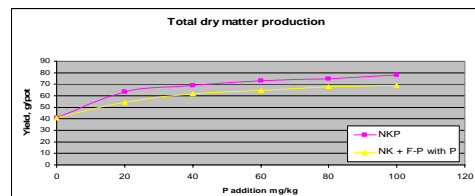
- Fine sand, organic matter content 3.3%
- P concentration 3.6 mg/100 g soil (ammonium lactate method, P status “medium”)
- Italian ryegrass, 3 cuts during 2.5 months
- Pots (5-litre) in a roofed cage

### ...Pot experiment 2004 / Materials and methods

- Plant nutrition treatments:
  - NK
  - NPK on the P addition levels 20, 40, 60, 80 and 100 mg P/kg soil
  - NK + P-saturated Filtralite P<sup>®</sup> on the P addition levels 20, 40, 60, 80 and 100 mg P/kg soil
  - NK + unused Filtralite P<sup>®</sup> at two levels

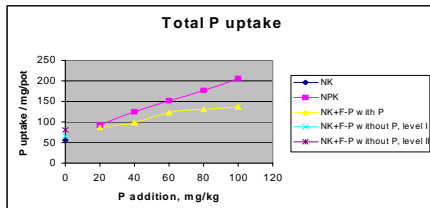
### Results / yield

Mineral P increased yield by 56 – 92 % and P-saturated Filtralite P<sup>®</sup> by 34 – 71 %.



### Results / P uptake

NPK increased P uptake by 66 - 270 % and P-saturated Filtralite P<sup>®</sup> by 56 - 147 %.



### Utilisation (%) of added P at different P levels

P-level, mg/kg	Mineral P	Filtralite P <sup>®</sup>
20	41%	34%
40	39%	24%
60	36%	25%
80	34%	21%
100	33%	18%
<b>Average</b>	<b>37%</b>	<b>24%</b>

### Conclusions/1

- Saturated Filtralite P<sup>®</sup> was an effective P fertiliser, even though not quite as effective as mineral P fertiliser.
- The filter beds cannot be completely P-saturated in order to ensure an effective P removal by the filterbed.

### Conclusions/2

- However, 25% P-saturation leads to accumulation of 1700 mg P/kg of filter material.
- Approximation: Even 25% P-saturated Filtralite P<sup>®</sup> can meet the P requirement of a crop (10-15 kg P/ha) if applied at the rate of 6-10 tons/ha.

### Conclusions/3

- The results obtained with Filtralite P® saturated in the lab needs to be verified with materials obtained from real filter beds, as soon as such materials become available.

