## Multiple usage of shortrotation willow plantations in Estonia

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# Estonian renewable energy production

#### Estonian peat production





#### Estonian firewood&chips production



•Production of wind energy in 2004 0,1\*10<sup>3</sup> TJ

### Estonian agricultural land usage



- Arable land use declined
  611 th ha
  - Area of traditional crops decrease
  - Only rapeseed increased

### Production of biomass for energy

• Traditional renewable energy resources almost exhausted

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- Prices of firewood and chips are rising fast
- Special energy crops? Short rotation plantations?

# Short rotation plantations in Estonia

Salix viminalis

Salix dasyclados



### Economics of SRP

- Income depends on biomass yield
- Mineral fertilization about third of the expenditure



# Fertilization with municipal sludge

Area: 0.44 ha Municipal sludge: 6.3 t (d.w.) applied in May, 2001  $N - 304 \text{ t ha}^{-1};$   $P - 217 \text{ t ha}^{-1};$  $K - 46 \text{ t ha}^{-1}$ 

# Fertilization with municipal sludge

Depth (cm)

10

40

10

40

Year

2001

2002

Plot

control

control

control

control

fertilised

fertilised

fertilised

fertilised



•Sludge application increased the yield of most clones

4,5

BOD7 (mgO l<sup>-1</sup>)

<3.0

<3,0

<3.0

<3,0

<3,0

<3,0

N (mg l<sup>-1</sup>

3.9

4,8

1.7

1,3

2,8

2,7

2,4

 $P (mg l^{-1})$ 

2,3

1,3

0,4

0,3

0,1

2,1

0,4

0,5

•Sludge application did not cause groundwater pollution





# Fertilization with wastewater

#### July, 2003



# Fertilization with wastewater

- Wastewater supply to SRP did not cause groundwater pollution
- Addition of water and nutrients to SRP increases the yield of shoot biomass
- However, it also increase the yield of weeds

### Conclusions

- Additional biomass for Estonian energy is needed
- Willow SRP can be one option profitable for Estonian farmers
- Both economical and environmental benefit from SRP can be increased with usage of sewage sludge or municipal wastewater for fertilization
- Additional studies are necessary to increase the profitability

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