Mechanization of scarification, planting and cleaning -Finland

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NB NORD workshop & seminar
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Mechanized soil preparation

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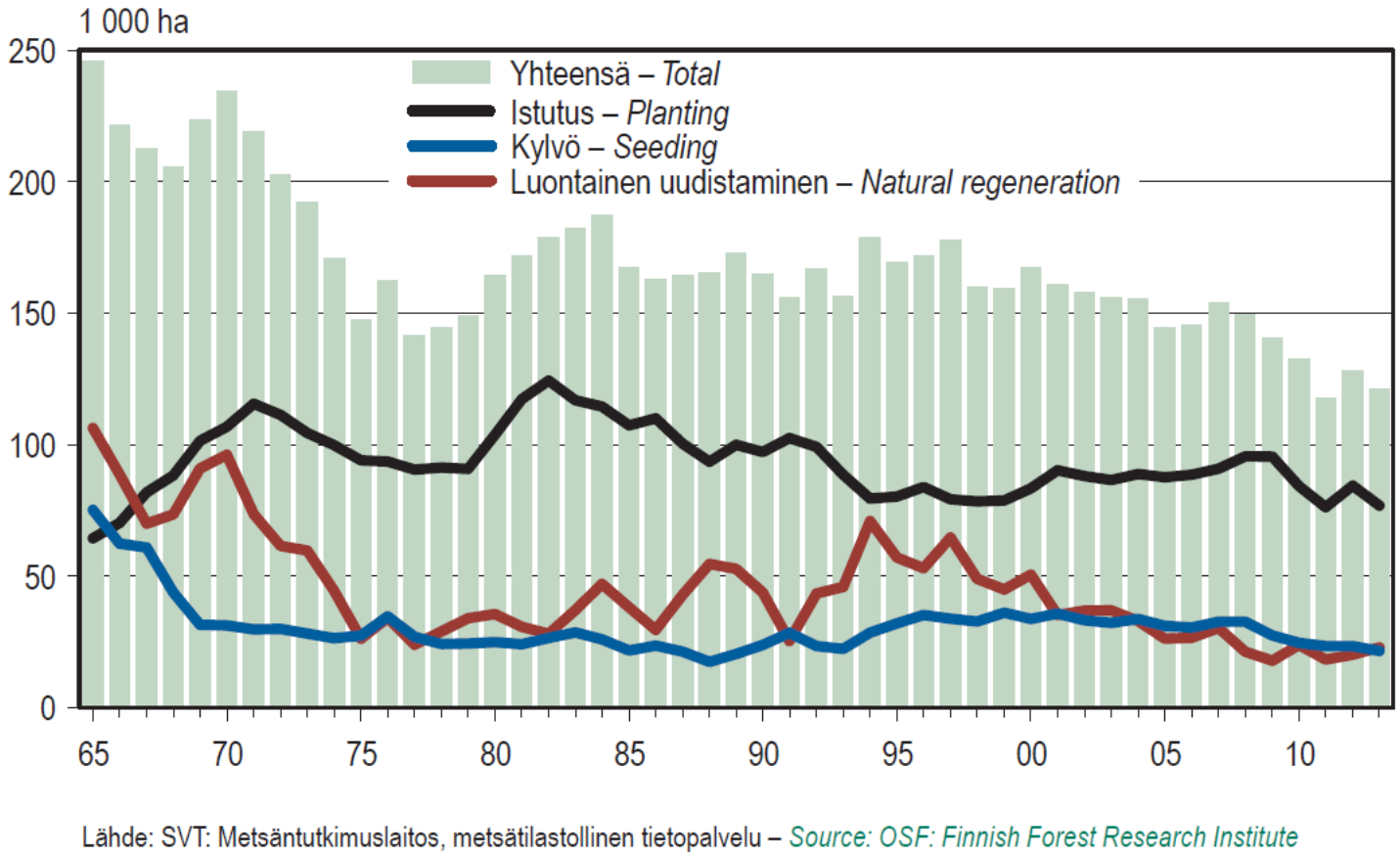
Forest regeneration in Finland



Lähde: SVT: Metsäntutkimuslaitos, metsätilastollinen tietopalvelu – *Source: OSF: Finnish Forest Research Institute*

In the last years 120 000 ha /year

After 2000: natural regeneration 20 %, direct seeding 20 %, planting 60 %

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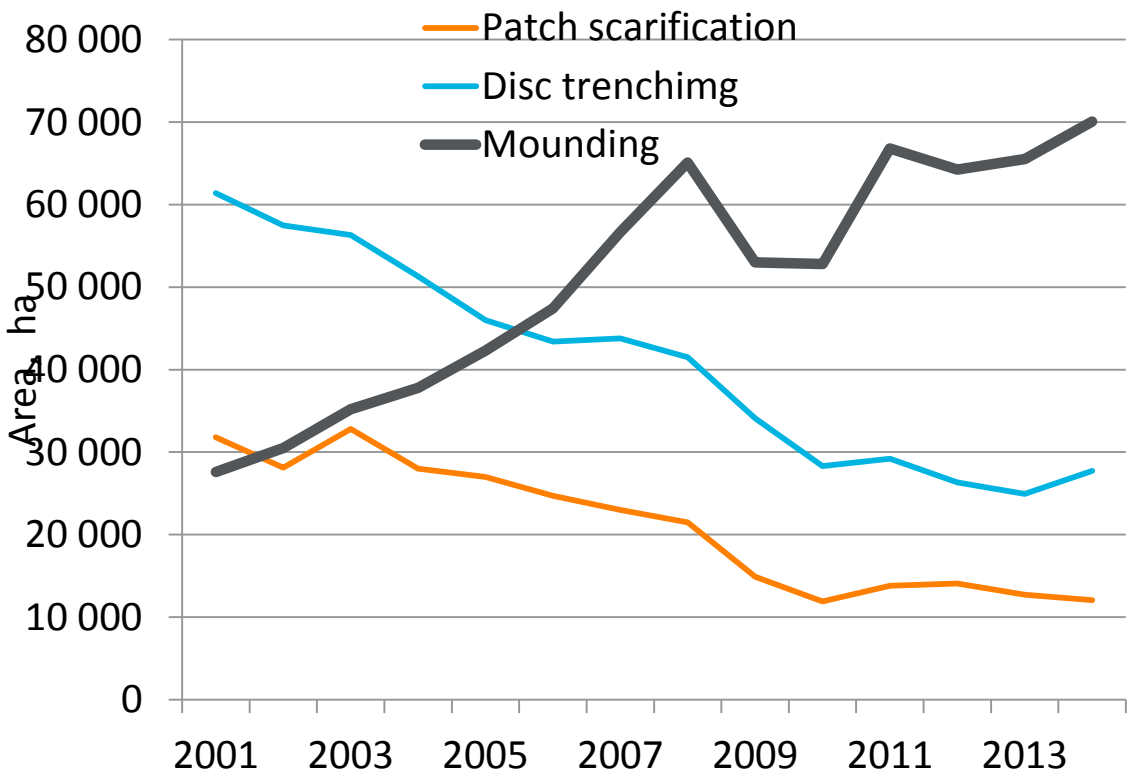
Soil preparation

Total forest regeneration area about 120 000 ha yearly.

Soil preparation area 100 000 – 110 000 ha yearly.

Nearly all planting sites are soil prepared.

Today mounding is most common soil preparation method especially on planting sites.



Selection criteria for soil preparation method

Fertility of site (competition from ground vegetation)
- poor sites → just open the soil surface
- fertile sites → elevated position for planted seedling

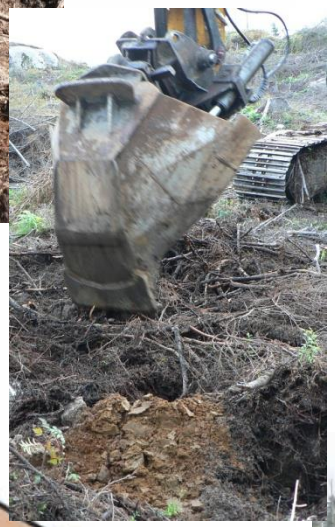
Soil texture (frost heaving)
- fine textured soils → minimize frost heaving (cut capillary water movement with soil preparation)

Watertable
- adjust soil preparation method with ditching operations

Tree species
- density of soil preparation tracks according to the tree species in question

The special properties of the regeneration site
- stoniness, declination, water protection etc.

Choice of soil preparation method



Wet

Water table

Dry

Mounding with drainage ditches

Mounding with small ditches

Spot mounding

Inverting

Disc trenching
Patch scarification

Fine

Medium coarse

Coarse

Soil texture

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Choice of soil preparation method

Dry sites (*Cladonia* , *Vaccinium* forest site types)

Scots pine as domidant species
- -natural regeneration
- - direct seeding
- - (planting)

Competition from ground vegetation is rather low

Open the mineral soil or move the raw humus layer away

→ Disc trenching or patch scarification

Choice of soil preparation method

Fertile sites (*Myrtillus and Oxalis-Myrtillus* forest site types)

Norway spruce, Silver birch

Scots pine on the most barren sites

- planting

Competition from ground vegetation is high

The planting point should be a bit higher than the ground level

→ mounding

- mounding method should be chosen according to water relations on the site

Spot mounding

Water relations should be in good condition.

Inverting

Water relations should be in good condition.

Mounding with small ditches

Small ditches have only a very local drainage effect .

Mounding with drainage ditches

The site needs real drainage and excess of water have to be transfered away from site.

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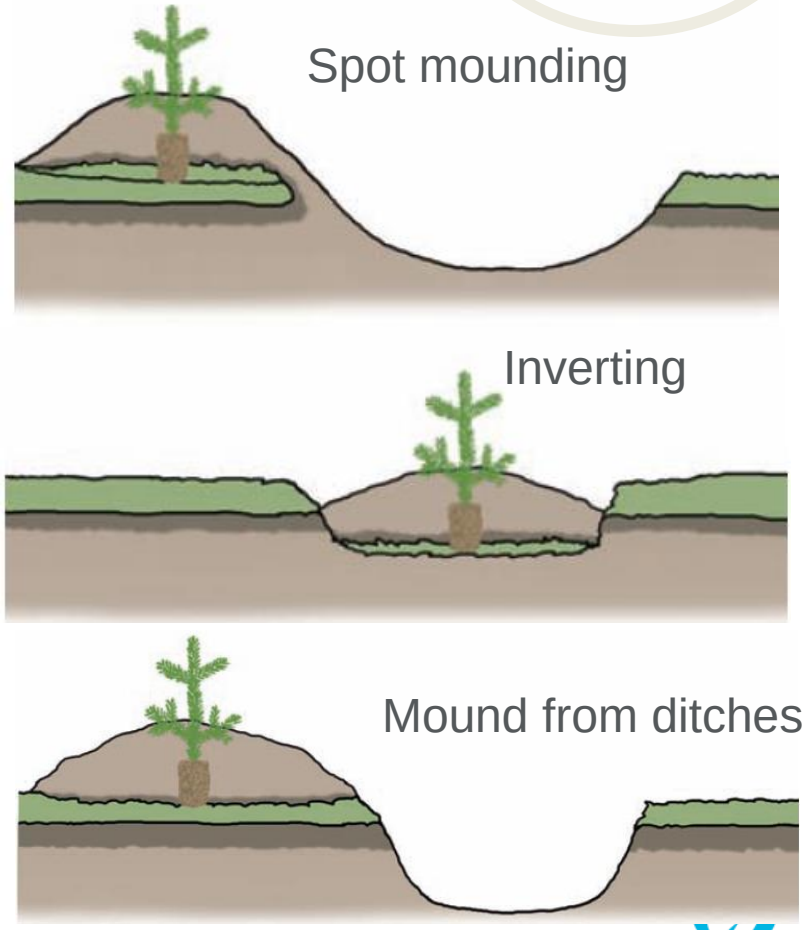
Optimum mound

In spite of mounding method the seedling should be planted so that its roots will reach the humus layer inside or below the mound.

Planting depth should be at least 5 cm because erosion makes the mound lower.



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Mechanized planting

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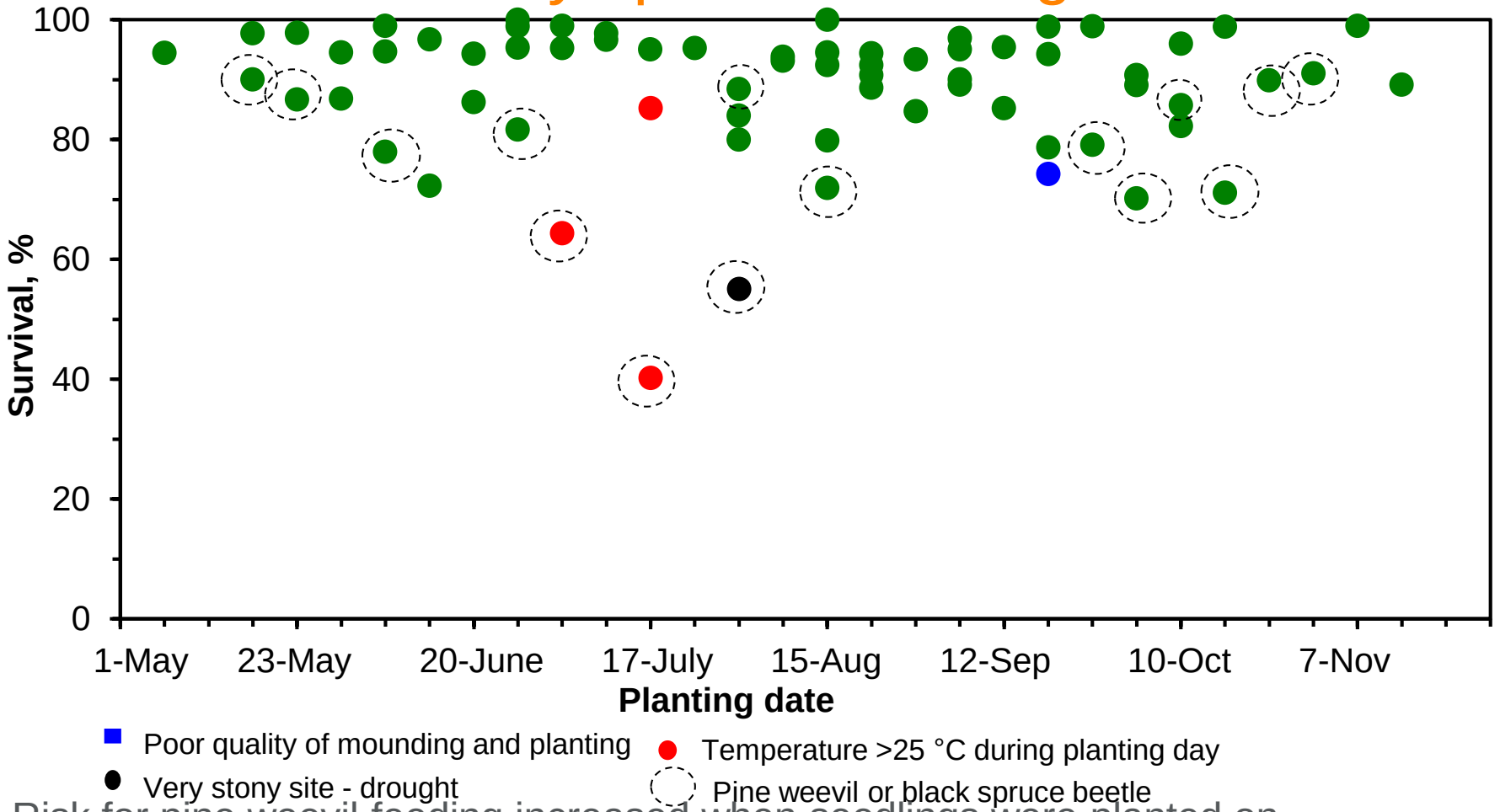
Three planting machines models, same working principle

Bracke, M-Planter, Risutec

About 40 devices in Finland, 3-4 % of seedlings are planted with machines. Planting period from beginning of May to beginning of October.

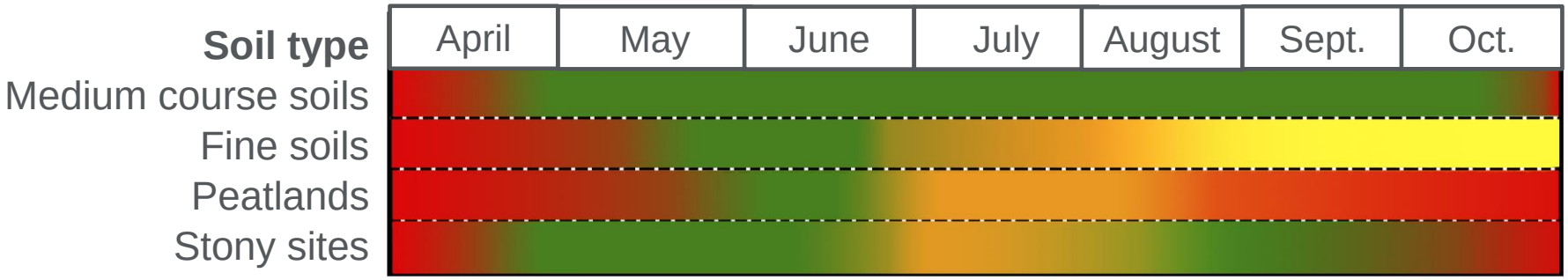
Effect of machine planting or planting date on survival of Norway spruce seedlings were minor



Risk for pine weevil feeding increased when seedlings were planted on humus-dominated mounds or seedlings suffer drought just after planting

Based on Luoranen, J., Rikala, R. & Smolander, H. 2011. Machine planting of Norway spruce by Bracke and Ecoplanter… Silva Fennica 45(3): 341-357.

Any restrictions when selecting sites to different planting windows?



Green color is the recommended window for a soil type

red for windows with ground frost (deeply frozen, slow thawing)

orange for sites and windows with high drought risk

yellow for sites and windows with high risk of frost heaving

Avoid to plant

- easily drying sites in summer (course, stony)
- fine textured soils in autumn

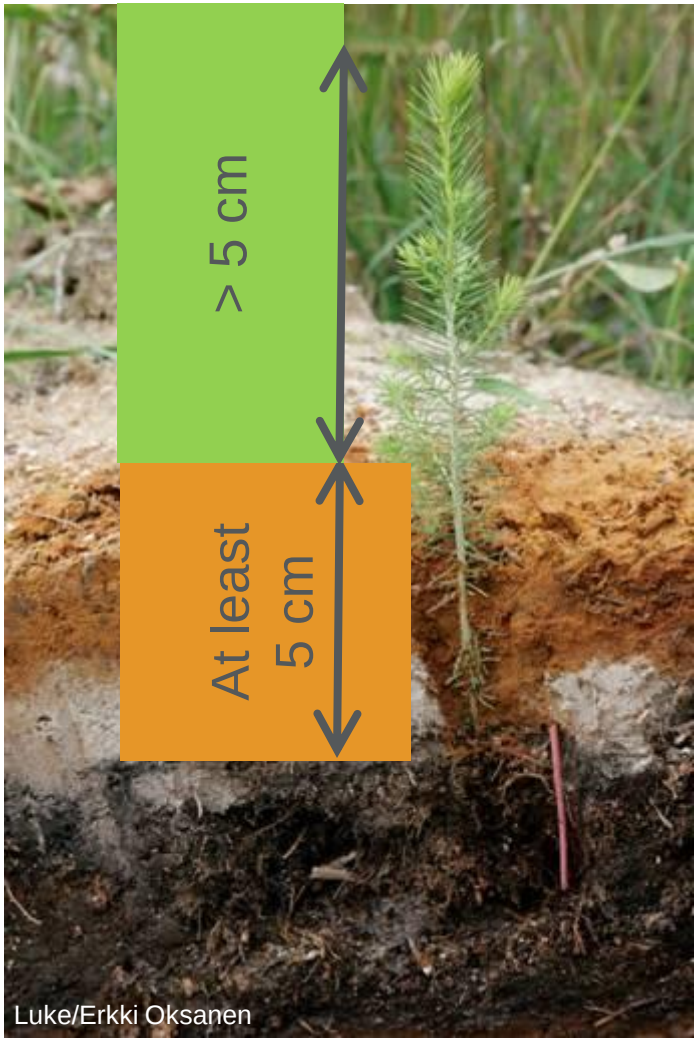
Plant tree species suitable for site type: not spruce in too dry sites


Risto Rikala

Requirements of seedlings in machine planting

- Tree species: spruce, pine, deciduous species (at least silver birch in Finland)
- Same origin and healthy criterion as for manual planted seedlings
- Developmental stage of seedling material is suitable for planting window
- Root binds the peat plug, but roots have not grown from plug to plug or root density within a plug is not too high
- Seedling size is suitable to used growing density and cell volume

Target size of machine planted seedlings 11–20 cm for pine, 14–30 cm spruce



At least a half of shoot should be above the soil surface: Enough green biomass above the soil surface to ensure good growth and survival of seedlings

Uniform mineral soil layer on the mound have to be approximately 5 cm thick

Root plug have to be planted into the double humus layer in the middle of mound

- drought
- frost heaving

Mechanized PCT

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Mechanized PCT

A recent estimate suggested that machines account for less than 1 % of the early cleaning and pre-commercial thinning work in Finland.

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Uprooting

Naarva uprooter (Pentin Paja Oy)

Working principle

Uprooting device is attached to harvester boom tip and use hydraulic jaws to grip and lift unwanted trees from the ground and break their roots.

Afterwards these uprooted broadleaved trees will not sprout again which means that there is no need for later pre-commercial thinning in the young stand.

Naarva uprooter

Young plantations

The timing of uprooting operation is essential. The height of crop trees should not be much more than one meter.

According to studies 3%-6% of crop seedlings are seriously damaged during the uprooting operation.

Uprooting can be used also in direct seeded Scots pine stands as early cleaning device.

Naarva uprooter

Productivity

According to time consumption studies the measured mean time consumption of uprooting was 6.3 pwh/ha for Naarva P25 device.

Productivity decreased as the number of broadleaved saplings and their height increased.

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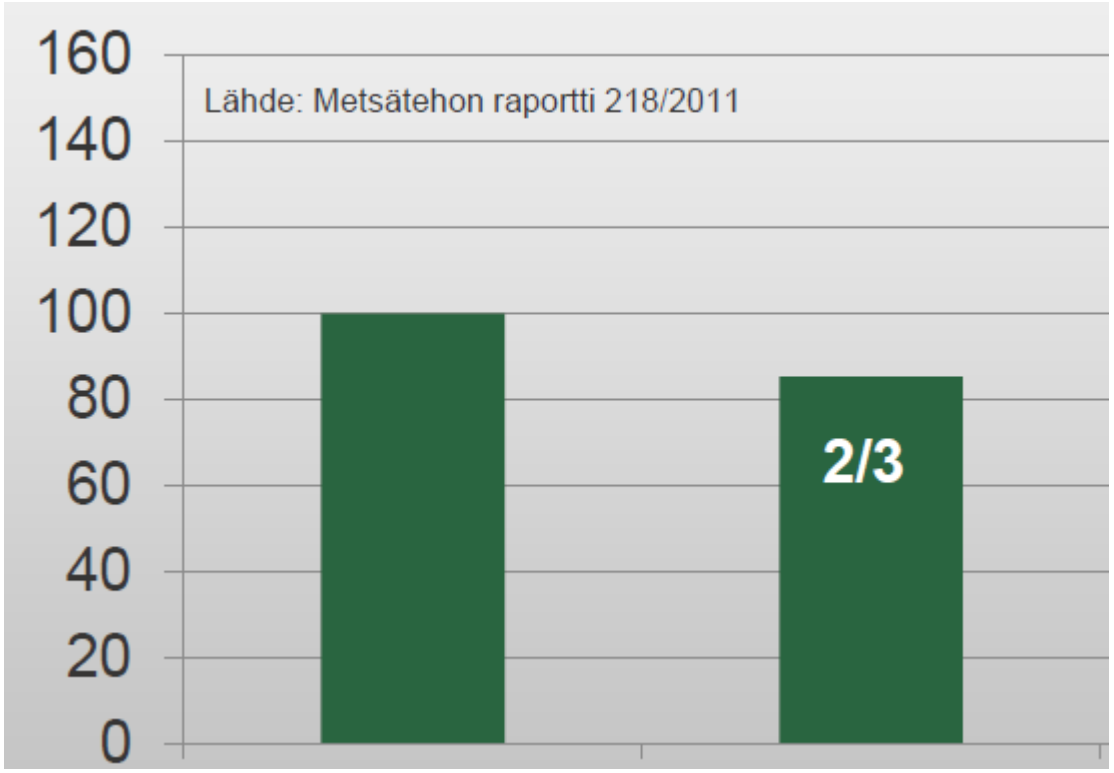
Naarva uprooter

Competitiveness

If no later pre-commercial thinning is needed (in 2/3 of cases), cost-efficiency can reach the level of the motor-manual work.

Worksite selection for mechanized uprooting and right timing of the work are the key factors.



EC= early cleaning, PCT=pre-commercial thinning

New innovation:
Biocontrol of sprouting after early PCT

Chondrostereum. purpureum fungus was sprayd trough the cutting device on the new stump in order to prevent sprouting.

First practical level experiments ongoing.

Thank you!

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