Research activities on mechanization of Forest regeneration operations in Latvian State Forest Research Institute “Silava”

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Soil preparation method "mounding" in Latvia

(history, innovations and projects of technology transfer)

Dr. silv. Dagnija Lazdiņa

(European Social Fund's project
Ecological and technical aspects of cultivating vital spruce stands
No. 2013/0022/1DP/1.1.1.2.0/13/APIA/VIAA/052)
On mounds - all commercial species
Mounding is good (but expensive) method of soil preparation
Different productivity:

- **Blade** – 110 cm wide ~11 operating hours ha\(^{-1}\) 138 ha per season
- **MPV 600** – 60 cm wide 6-9 operating hours ha\(^{-1}\) 169-248 ha season
- **Karl – Oscar** – 50 cm wide 5.5 operating hours ha\(^{-1}\) 279 ha per season
Improving of productivity – two mounds one device

1 + 1 = ~ + 25% productivity

OSCAR Workshop: “Mechanized and efficient silviculture”
November 25 – 26, 2015 Natural Resources Institute Finland,
Suonenjoki Research Unit, Finland
Transfer of technologies or ideas!?
Decreasing of scarification - two mounds one pit

More mounds per ha = less scarification of soil!

2 + 2 - 1 = ~ 25% scarification
**Different quality:**

- **Sertification system**: “no more than 30% of mineralized soil”
- **Rules of forest regeneration**: “2000 of spruce 3000 of pine per ha”?
- No all trees could be planted on mounds?!
- No all trees should be planted – use natural regeneration + planting?!

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**Number of mounds/forest site:**

- **Blade 110 cm**
- **Spring, blade 60 cm**
- **Autumn, blade 60 cm**
- **Autumn, blade 50 cm**

**Scarcified % from area:**

- **Myrtillosa mel.**
- **Myrtillosa turf. mel.**

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**Certification system**: “no more than 30% of mineralized soil”

**Rules of forest regeneration**: “2000 of spruce 3000 of pine per ha”?

No all trees could be planted on mounds?!

No all trees should be planted – use natural regeneration + planting?!
Stump lifting + mounding = one bucket, two operations

Is stump lifting = soil preparation?
Stump lifting as soil preparation - how effective it is?
New Holland E215B excavator with MCR-500 stump lifting bucket
Komatsu PC210LC excavator with CBI stump extraction bucket
Distribution of biomass & share of rotten stumps

Total biomass - 136 tonnes

- Spruce 83%
- Birch 8%
- Aspen 2%
- Pine 6%

Visually healthy stumps vs Rotten stumps

Number of stumps vs Diameter of stump
Comparison on productivity:

- Both buckets and operators

![Graph showing productivity comparison between CBI and MCR-500 for different activities including driving, turning, reaching, catching, pulling, splitting, shaking, dropping, searching, and other tasks.]

- **Visually healthy stumps** compared to **rotten stumps**

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Productivity of extraction of stumps of different species

Aspen

\[ f(x) = 197.79x^{-1.19} \]

\[ R^2 = 0.69 \]

Birch

\[ f(x) = 330.78x^{-1.42} \]

\[ R^2 = 0.73 \]

Pine

\[ f(x) = 631.59x^{-1.69} \]

\[ R^2 = 0.7 \]

Spruce

\[ f(x) = 221.48x^{-1.38} \]

\[ R^2 = 0.87 \]
Impact of diameter on size of extracted stumps
Cost of stump biofuel

- Considerable reduction of cost can be achieved if stumps with diameter below 20 cm are left untouched.
- The most efficient solution to reduce the cost of stump extraction is soil scarification simultaneously with stump lifting.
- Two step comminution of biomass can also reduce cost and improve quality of biofuel.

- The prime cost of chips from stumps is **12.3 EUR LV m\(^{-3}\).**
- Stump extraction is 21% of the prime cost.
Mineralized soil after stump removal

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Mineralized soil, %
Location of survived seedlings

- **Control**
- **Stumps removed**
- **Stumps removed + mounds**

**Graphs**

- Furrow
- Mound
- Unprepared / furrow edge
- Scarified
- Bridge

**Percentages**

- 0%
- 10%
- 20%
- 30%
- 40%
- 50%
- 60%
- 70%
- 80%
- 90%
- 100%

**Legend**

- Dm
- Dms
- Vr
- As

**Notes**

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Additional **organic nutrients** - benefit from mounding
If additional minerals is needed ... to fertilize or to improve soil qualitative parameters by additives