

Forest regeneration quality – factors affecting first year survival of planted trees

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Introduction

- In Latvia one third part of reforestation is done by planting
- Early stage of forestry is crucial for successful and sustainable forest management





Aim of the research



To evaluate the impact of different soil preparation methods on survival and growth rate of different type of seedlings after first growing season.

- Compare survival rate and annual increment of trees planted in soil prepared in mounds or furrows.



Material and methods

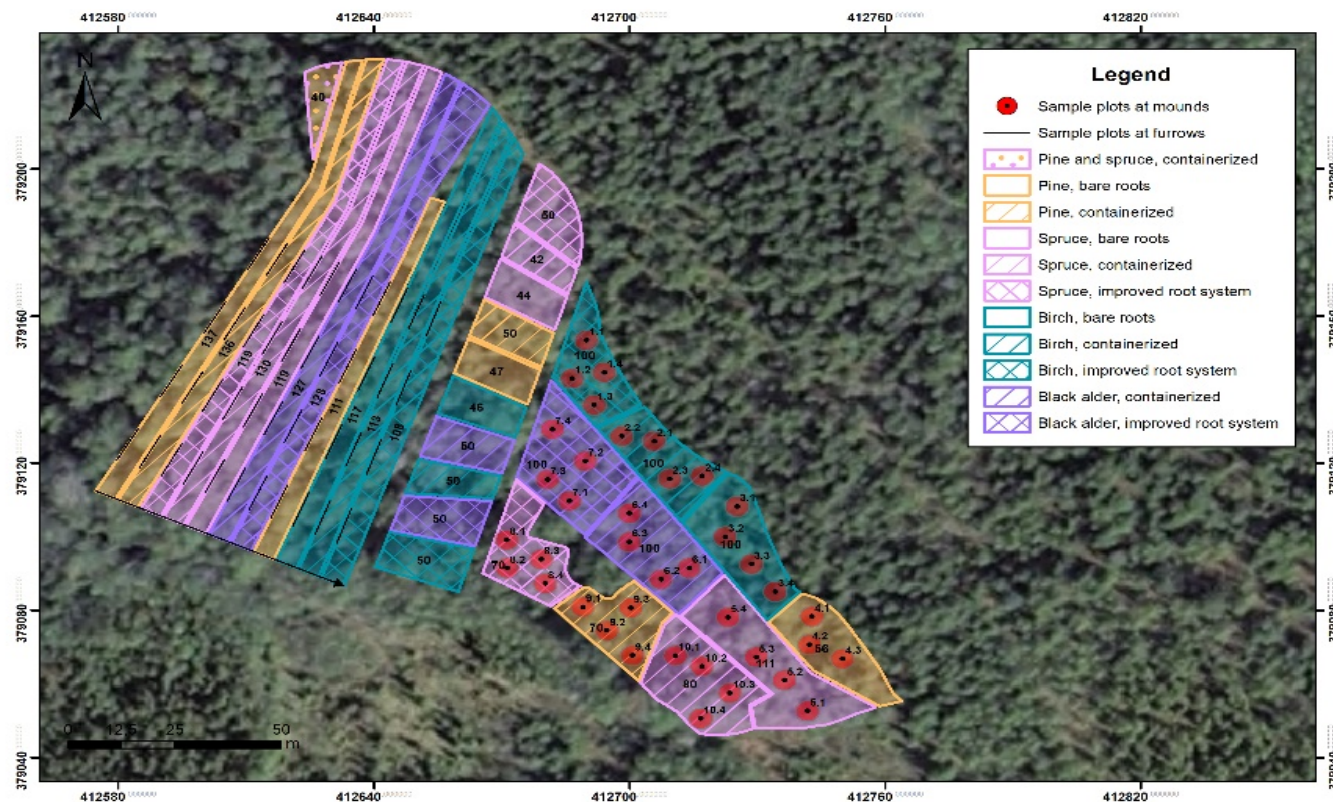
- Six young stand sites
- Three forest type: *Myrtilloso-sphagnosa*, *Myrtillosa mel.*, *Vacciniosa mel.*
- Four tree species
- Tree seedling types
- Disc trenching, mounding, unprepared soil



Improved root system, containerized seedling



Soil prepared in mounds and furrows, seedling location



Example of sampling plot design, red dots sample plots at mounds and black stripes sample plots at furrows



Myrtillosa mel. unprepared soil and soil prepared in mounds, 15.07.2017.

Results



Seedling survival rate (%) depending on soil preparation method (Dt - disc trenching, M - mounding, U - unprepared soil)



| Species and seedlings | <i>Myrtilloso-sphagnosa</i> | | | <i>Myrtillosa mel.</i> | | |
|-----------------------------------|-----------------------------|--------------|--------------|------------------------|-------------|--------------|
| | Dt | M | U | Dt | M | U |
| Spruce, bare roots | 92.5 ± 2.94 | 94.6 ± 3.71 | 91.46 ± 3.08 | 93.5 ± 2.22 | 94.8 ± 3.53 | 100 |
| Spruce, containerized | 92.7 ± 3.12 | 97.5 ± 2.48 | 94.5 ± 2.39 | 96.11 ± 1.90 | 93.7 ± 3.52 | 96.6 ± 3.27 |
| Spruce, improved root system | 96.2 ± 2.17 | 100% | 96.0 ± 1.96 | 99.0 ± 0.85 | 95.7 ± 2.94 | 100 |
| Birch, bare roots | 88.6 ± 5.38 | 95.2 ± 2.8 | 89.6 ± 4.41 | – | – | 80.7 ± 7.72 |
| Birch, containerized | 94.4 ± 2.73 | 97.4 ± 2.53 | 92.33 ± 0.84 | 83.6 ± 3.52 | 81.8 ± 6.71 | 95.2 ± 2.34 |
| Birch, improved root system | 97.2 ± 1.82 | 100 | 96.77 ± 1.83 | 82.4 ± 3.67 | 91.2 ± 4.86 | 83.3 ± 8.78 |
| Black alder, bare roots | – | – | – | 75.8 ± 7.42 | 84.2 ± 8.36 | 87.5 ± 11.69 |
| Black alder, containerized | 94.3 ± 2.77 | 100 | 94.7 ± 2.56 | 93.8 ± 4.28 | 94.7 ± 3.62 | 92.0 ± 5.42 |
| Black alder, improved root system | 100 | 100 | 100 | 88.6 ± 5.34 | – | – |
| Pine, containerized | 98.6 ± 1.31 | 100 | 93.6% ± 2.77 | 84.1 ± 4.03 | 93.8 ± 3.42 | 95.5 ± 2.52 |
| Pine, bare roots | 82 ± 3.66 | 93.75 ± 4.28 | 71.1 ± 6.28 | 79.1 ± 4.5 | 78.5 ± 6.33 | 98.2 ± 1.12 |



Seedling proportional mean increment (%) depending on soil preparation method (Dt - disc trenching, M - mounding, U - unprepared soil)



| Species and seedlings | <i>Myrtilloso-sphagnosa</i> | | | <i>Myrtillosa mel.</i> | | |
|-----------------------------------|-----------------------------|--------------------|---------------------|------------------------|--------------------|---------------------|
| | Dt | M | U | Dt | M | U |
| Spruce, bare roots | 12.1 ± 0.73 | 12.1 ± 0.74 | 17.16 ± 1.1 | 17.9 ± 0.85 | 16.5 ± 1.25 | 19.5 ± 1.87 |
| Spruce, containerized | 23.9 ± 0.91 | 23.1 ± 1.48 | 23.4 ± 0.6 | 25.9 ± 1.23 | 24.7 ± 1.30 | 19.5 ± 1.35 |
| Spruce, improved root system | 23.6 ± 0.87 | 20.5 ± 0.87 | 18.8 ± 0.70 | 15.7 ± 0.63 | 17.6 ± 0.86 | 15.2 ± 0.80 |
| Birch, bare roots | 20,1 ± 2.01 | 25.2 ± 1.04 | 20.0 ± 1.00 | – | – | 24.7 ± 2.91 |
| Birch, containerized | 25,5 ± 2,16 | 30.1 ± 1.59 | 27.5 ± 1.31 | 34,7 ± 1,33 | 39.7 ± 2.58 | 22.6 ± 1.81 |
| Birch, improved root system | 26,0 ± 0,87 | 29.5 ± 1.07 | 25.97 ± 0.75 | 30,1 ± 1.49 | 25.3 ± 1.93 | 32.8 ± 2.05 |
| Black alder, bare roots | – | – | – | 45.3 ± 2.62 | 65.5 ± 2.99 | 44.5 ± 11.95 |
| Black alder, containerized | 19.6 ± 0.95 | 20.6 ± 1.24 | 18.8 ± 0.67 | 27.0 ± 1.39 | 30.9 ± 3.93 | 40.7 ± 1.0 |
| Black alder, improved root system | 27.0 ± 1.55 | 29.3 ± 1.71 | 23.8 ± 0.89 | 25.6 ± 1.76 | – | – |
| Pine, containerized | 50.8 ± 1.37 | 45.6 ± 1.64 | 38.7 ± 1.31 | 43.2 ± 1.71 | 46.8 ± 1.38 | 48.5 ± 1.69 |
| Pine bare roots | 31.2 ± 1.14 | 39,2 ± 1.75 | 29.3 ± 1.78 | 40.5 ± 1.57 | 45.4 ± 2.56 | 44.8 ± 1.78 |

Conclusion



- Survival rate of outplanted seedlings differ by chosen stocktype and soil preparation method from lower than 20% survived scots pine bare root seedlings and reaching up to 100% survival rate of spruce, black alder seedlings planted on mounds and altogether soil preparation tend to increase planted tree survival.
- After seedling outplanting from nursery in forest land containerized seedling have higher mean proportional increment (35.9 ± 0.42 %) compared to other stocktype (26.6 ± 0.61 % for bare roots and 23.1 ± 0.31 % improved root system ($p < 0.05$)).
- Soil preparation method also impact damage rate caused by agrotechnical care from 1.4 % on mounds to 8.4% damaged trees in furrows made by disc trenching.



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