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Rutting on skid trails - Static and dynamic pressure allocation
Overview of the project

Main points

• “Bodenschonender Maschineneinsatz im Wald” (BoMaWa) “Soil protecting use of forestry machines”

• Joint research project consisting of 3 participants from science and economy with support of government funding

• Four subprojects dealing with different methods and research interests
  1. contact pressure of tires and different kind of tracks
  2. rutting process
  3. soil physics
  4. development engineering
Material

Machine configurations

- Rottne F14 Solid
  - Mass: 18 tons
  - Capacity: 14 tons
  - Total: 32 tons

- 4 configurations:
  a) Nokian Nordman Forest 710/45 - 26.5
  b) Felasto-PUR Felastec
  c) Olofsfors Magnum
  d) Olofsfors Of
Material

Test stands

Beech-Oak mixed

Norway spruce
Measuring methods - rutting

Data recording

- Mobile scanning unit PS100-90 for surface registration before first and after each additional crossing
- Approximately 2.4 million points for each test-field (3m x 4m)
Results

Olofsfors Magnum

- 8 crossings
- 20% simulated inclination
- 12% slip
- 33% soil moisture
- Average rut depth: 4 cm
- Norway spruce
Results

Nokian Nordman Forest TRS

- 8 crossings
- no inclination simulated
- 3% slip
- 39% soil moisture
- Average rut depth: > 20 cm, > 2 cm each crossing
- Beech-oak-mixed stand
Results

Anova

- Big influence by configuration
- Little influence by number of crossings
- Two groups $\rightarrow$ FE1/MA vs. OF/Rad: significant differences between these groups
- Beech-oak mixed
Results

no roots, no humus  

roots, humus 5 - 10 cm
Results
Damages

Olofsfors OF

- 8 crossings
- no inclination simulated
- 41% soil moisture
- Average rut depth: 20 cm, > 2 cm each crossing
- Beech-oak mixed
Damages
Results

Key findings

• No differences between the four configurations in rutting (norway spruce)

• Differences between Felastec/Olofsfors Magnum and tires/Olofsfors OF in rutting (beech/oak)

• Soil moisture is one of the most important parameter causing ruts

• Thickness/kind of humus and root intensity seems to have big influence on rut depth and structural strengh of the skid trail
Dynamic contact pressure measurements

Goals

• Pressure allocation measurement under dynamic conditions

• Creation of a model for the description of the dynamic ground pressure load

• Deduce from the static measurements on the contact area the pressure under dynamic conditions
Dynamic measurements - New test stand
Dynamic measurements - contact area

Rutting on skid trails - Static and dynamic pressure allocation
Dynamic measurements - contact pressure

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Nokian Forest King</th>
<th>Felastec Felasto Pur</th>
<th>Olofsfors Magnum</th>
<th>Olofsfors OF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Static</td>
<td>100 %</td>
<td>71,1 % (-28,9 %)</td>
<td>81,6 % (-18,4 %)</td>
<td>n.a.</td>
</tr>
<tr>
<td>Dynamic</td>
<td>100 %</td>
<td>75,7 % (-24,3 %)</td>
<td>76,3 % (-23,7 %)</td>
<td>79,3 % (-20,7 %)</td>
</tr>
</tbody>
</table>
Thank you for your attention!