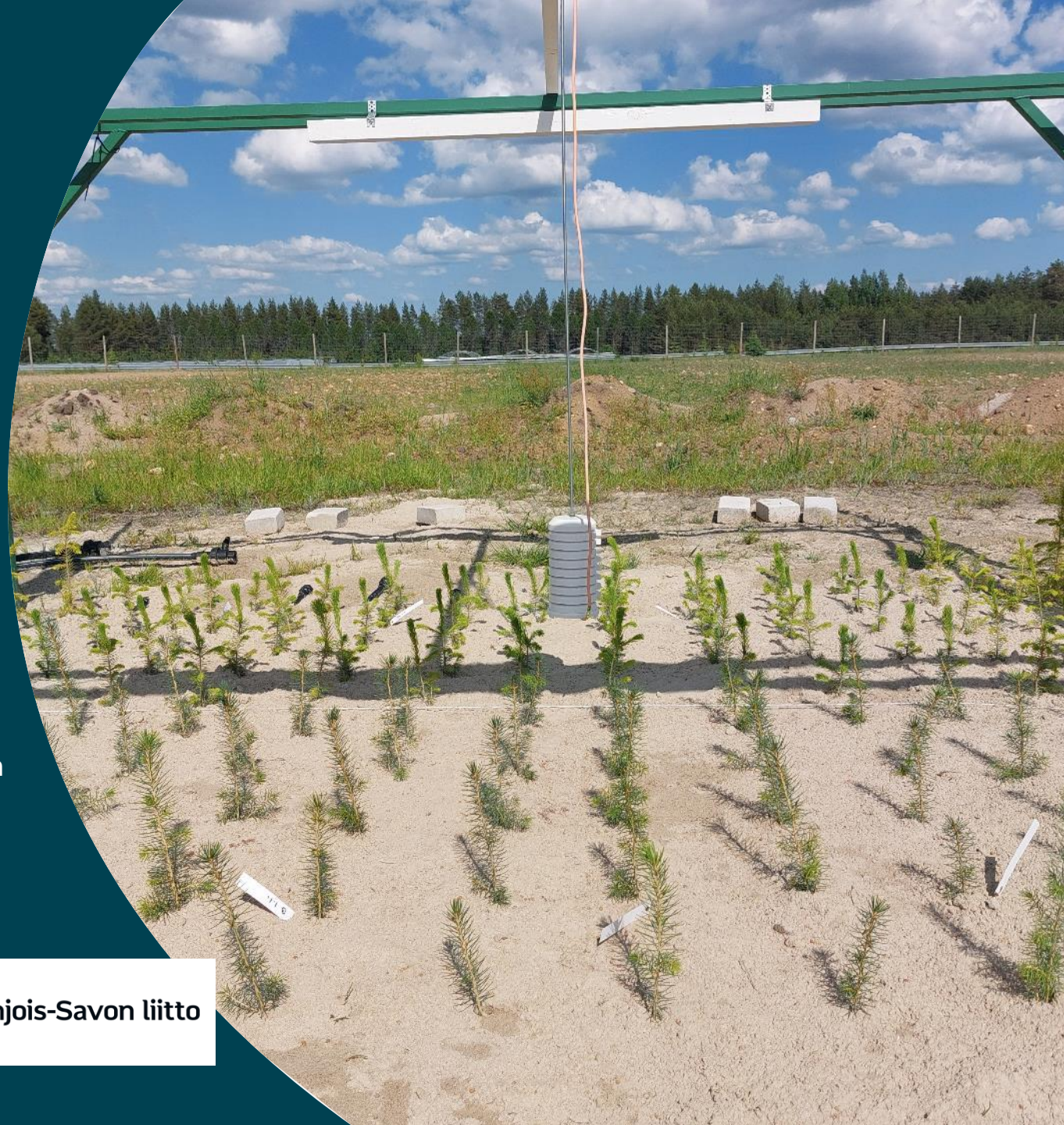
Norway spruce seedlings grown in peat substitutes – field success under climate change conditions



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Background

- >150 million container seedlings produced / year in *Spahgnum* peat in Finland

- Decrease in use of for energy purposes → impact on availability of peat as a growing medium

- Need for peat substitutes that produce
  - High quality,
  - High field success,
  - Climate-tolerant seedlings

Photo: Minna Kivimäenpää

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Growing media tested

Growing media*
Peat
Moss (*Spaghnum*)
Moss + N (slow release)
Peat : wood fiber 75:25
Moss : wood fiber 50:50
Moss : wood fiber 50:50 + N
Moss : cow manure digestate 75:25
Wood fiber : cow manure digestate 75:25

Photo: Hanna Ruhanen

* Both fertilized and limed ready-to-use products and self-made mixes

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Growing conditions

Sowing: 2.-4.5.2023

Species: Norway spruce (*Picea abies*)

Seed origin: SV113 (seed orchard), seed lot EY/FIN T03-21-0508

Tray: Plantek 81F (growing density 549 seedlings/m^2)

Place: Plastic greenhouse

Fertigation based on visual monitoring and EC measurements

Number of seedlings: 35 000

Overwintering: freezer storage and outdoors under natural snow cover

Photo: Minna Kivimäenpää

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Final growth

Peat | Moss | Moss + N | Peat : wood | Moss : wood | Moss : wood +N | Moss : digestate | Wood : digestate

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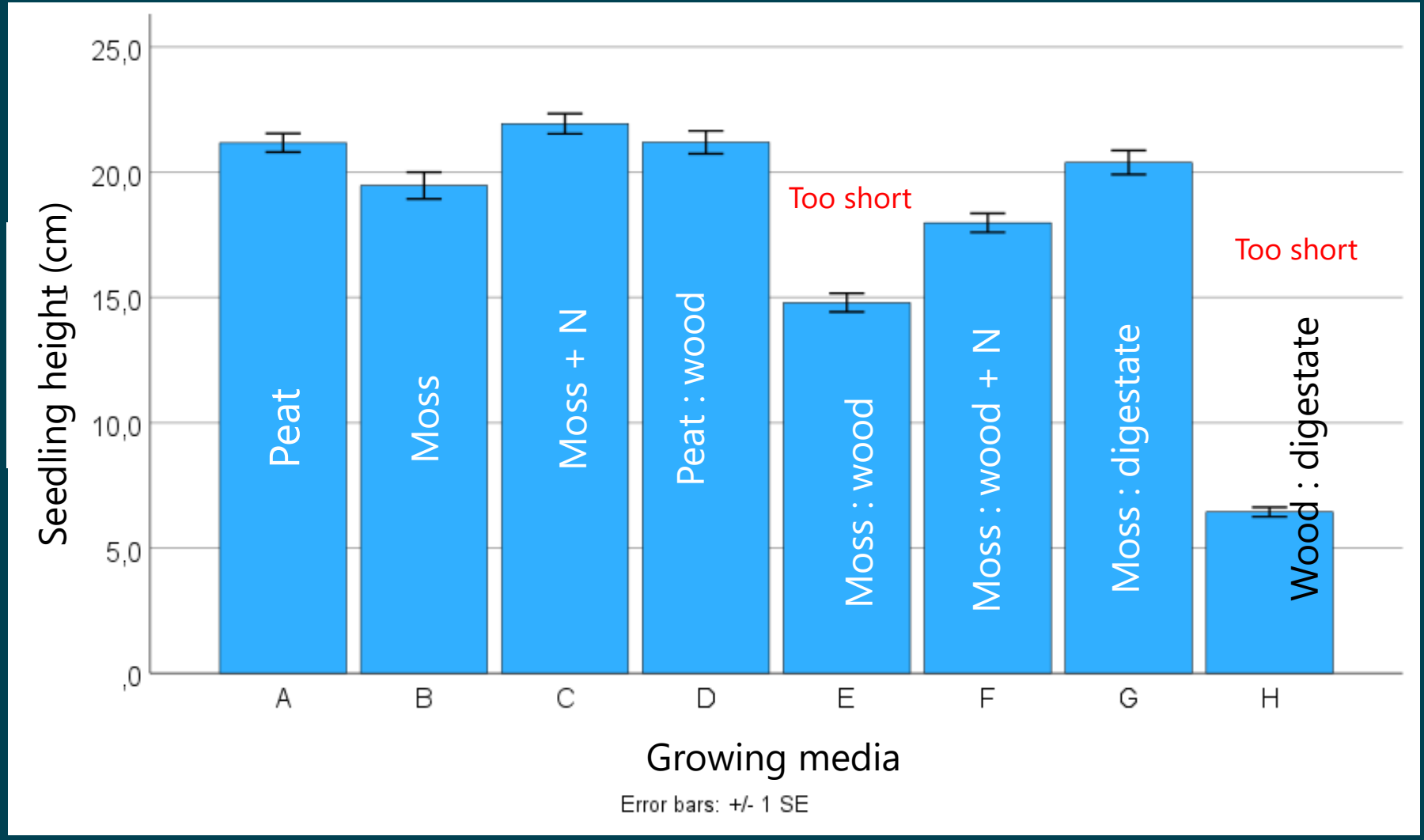
Final growth



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Yield and reasons of rejection

Rejection basis, growing media can affect

Growing media	Yield (%)	Germination (%)	Too short (%)	Color or structure (%)	Root plug integrity (%)	Other (%)
Peat	82	6	2	7	1	2
Moss	78	4	3	8	3	4
Moss + N	81	7	2	5	1	4
Peat : wood fiber	81	6	3	6	4	0
Moss : wood fiber + N	79	6	6*	5	1	3
Moss : cow manure digestate 75:25	82	7	4*	4	1	6
* Difference to peat (P<0.05)						

Growing media did not affect yield

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Field success

Planting in the Stress Test Field in Luke Suonenjoki on 4 June 2024

24 study plots

3 levels of warming (ambient, target +2 °C, target +5 °C), canopy and soil warming

2 levels of soil moisture: ambient precipitation, additional watering (to avoid drought)

Precipitation in summer 2024 lower than long-term average

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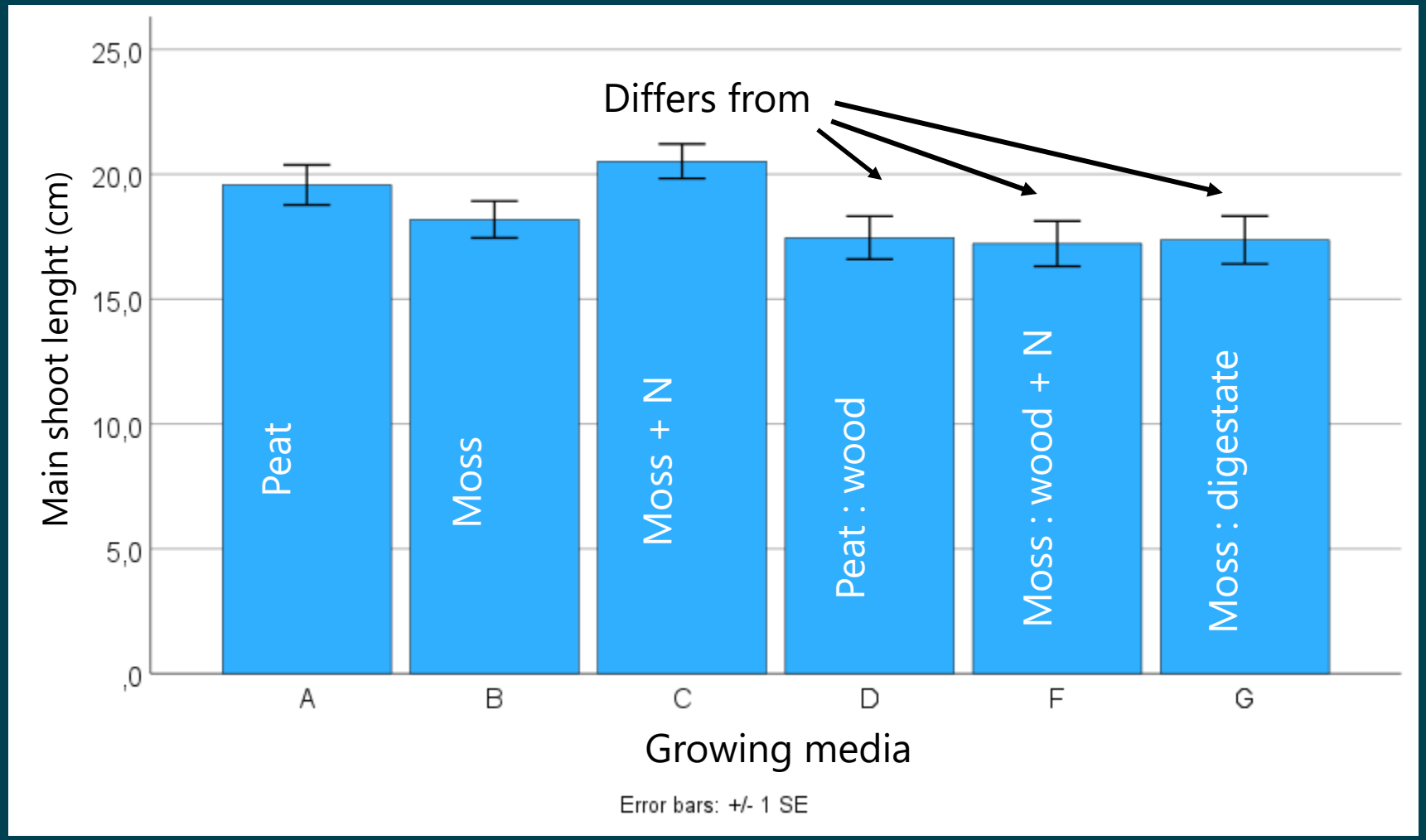
Growth: Main shoot lenght on 4 Sept 2024



No warming and watering effects on shoot growth

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Climate tolerance

Chlorophyll fluorescence (Fv/Fm)

- Lower in non-watered seedlings, indicating drought stress (July, August)
- Seedlings from different growing media responded in the same way – similar drought stress resistance

Insect damage

- Some interactions between watering treatments and growing media (July)
- In general, the seedlings look good (September)

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Conclusions

- Five of seven peat substitutes produced field-ready Norway spruce seedlings
- All thrived in the field under climate change conditions
- Response to drought stress was similar
- Differences between growing media expected in growth and carbon storage
- Caution on insect damage ?
- Monitoring required over winter and longer term

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Thank you!

https://www.luke.fi/en/projects/ilmastotaimet

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