

Fuel Quality Changes and Substance Losses during the Storage of Wood Chips - Part 2:

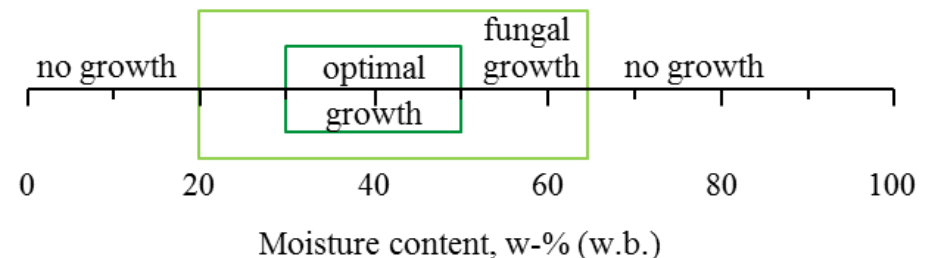
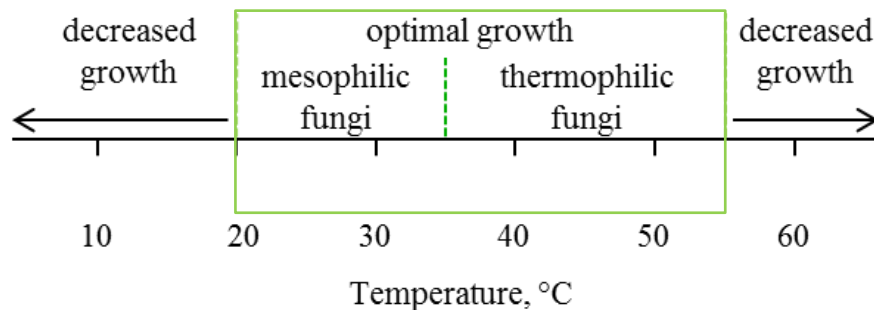
Container Trials to Examine Wood Chips under Small Scale Conditions

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Introduction

- Storage of wood chips can be used for **drying** purposes by the principle of natural convection, influencing factors:
 - Physical factors: Pile height, type of wood chip, particle size, etc.
 - External factors: Temperature, humidity, wind exposure, precipitation, etc.
- However, storage of fresh wood chips can lead to **high dry matter losses** due to microbial activity which is influenced by i. a.:



Study aim

- Fine content



(Examples for fine contents)

- Large specific surface area
 - High amount of easily available nutrients
 - Little air voids
- } enhanced microbial growth
- decreased porosity

➔ May lead to increased dry matter losses

➔ The aim was to examine the effect of screening on the storage behaviour of wood chips

Materials & Methods

- Storage of 5 wood chip types:

Same wood chips
as in field trials
(*ERC & FRC; Part 1*)



- Each wood chip type was stored:
unscreened (as received) and
screened (particle size > 8 mm)



Materials & Methods

- Storage of wood chips in small containers
- Storage location: rain and wind protected outdoor shelter
- Storage time: 23 weeks
- Wood chip analyses:

Moisture content, w-%

Particle size distribution

Dry matter losses, w-%

Wood chip weight, w-%

Wood chip temperature, °C

Air temperature & rel. humidity

} before and after storage

— after storage

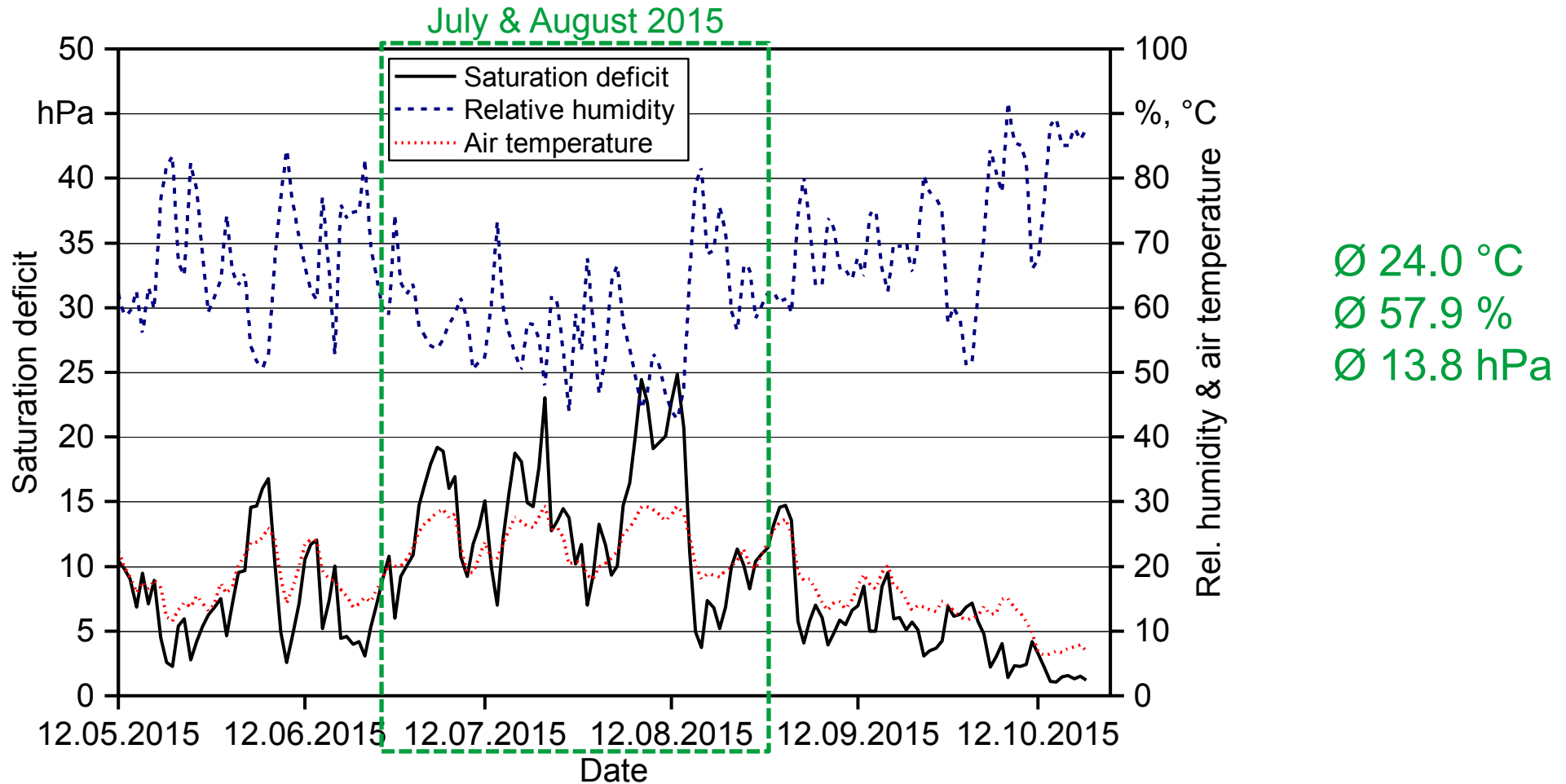
— every 3 weeks

} every 30 min



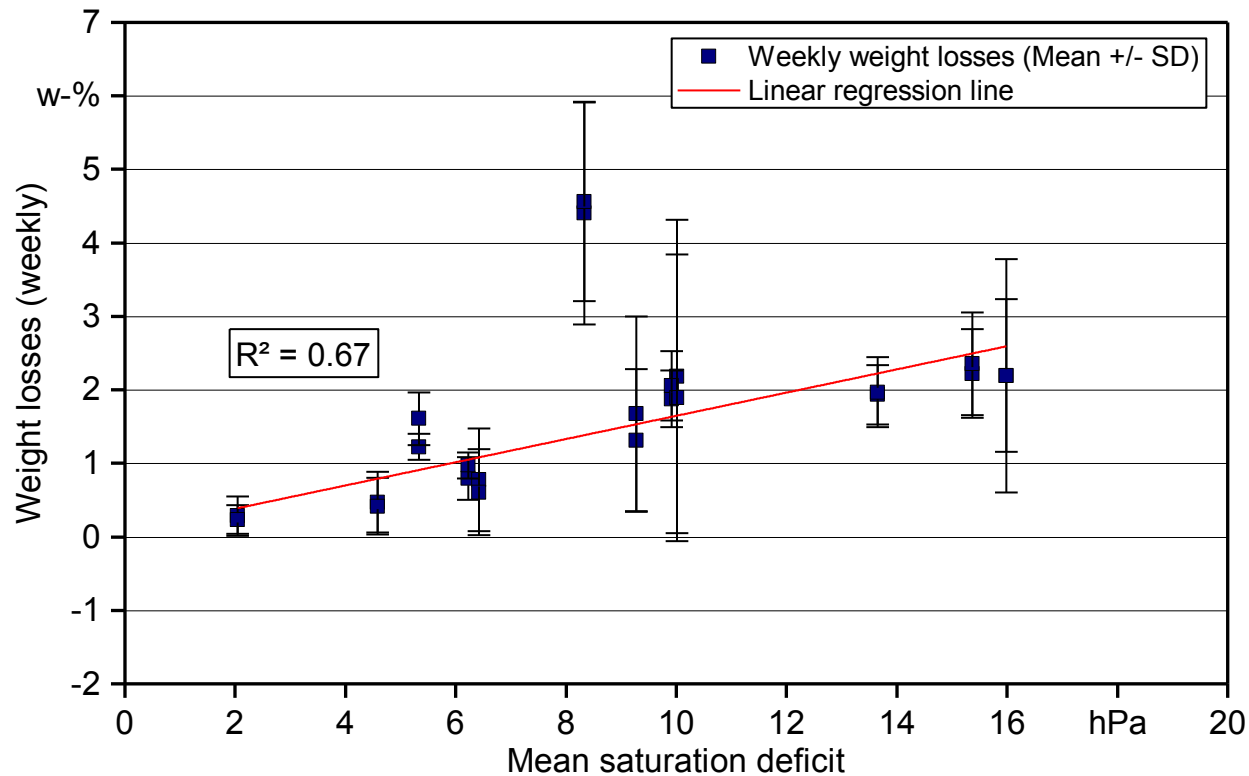
Results

- Air temperature, relative humidity and saturation deficit



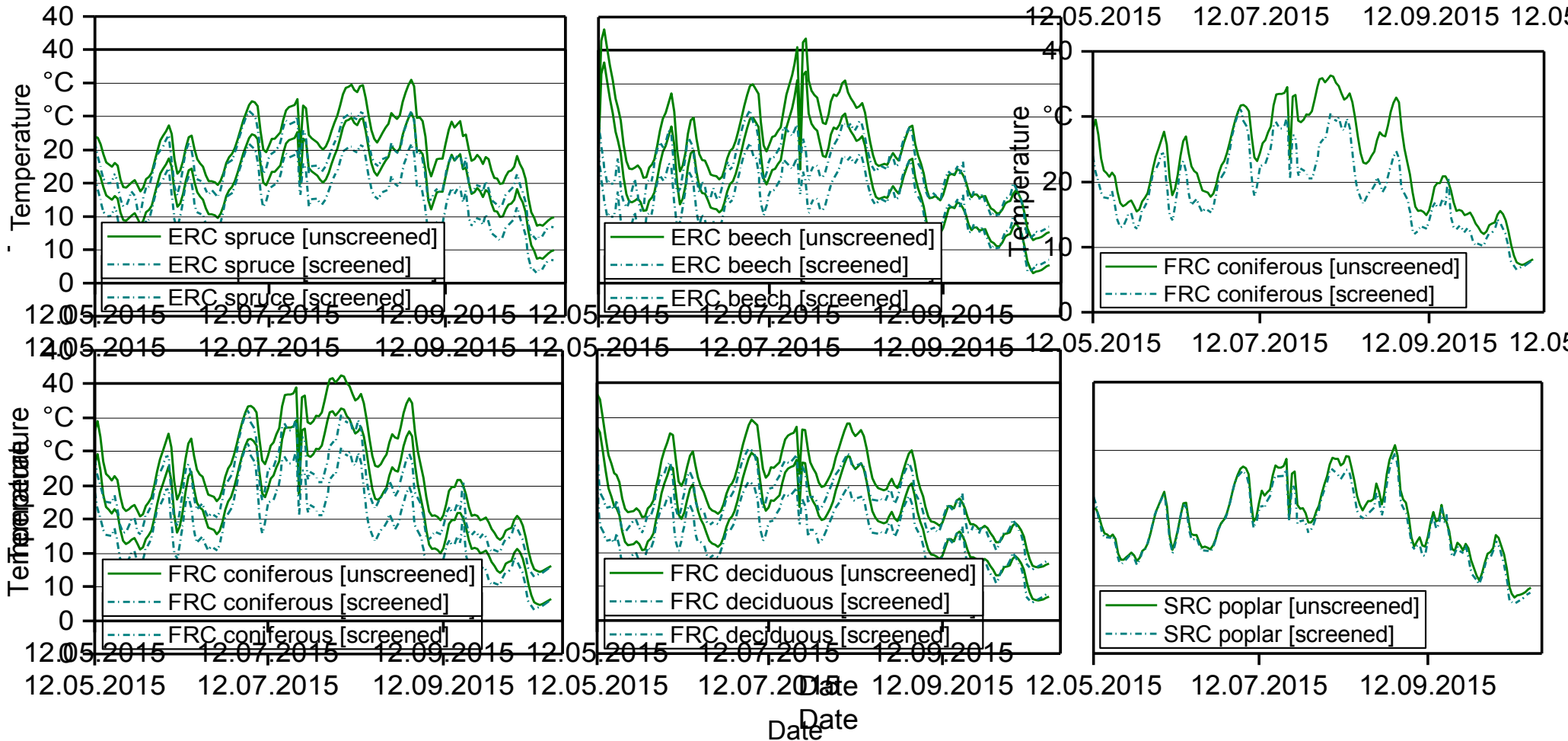
Results

- Mean weight losses (Δ abs.):
 - \emptyset 39 w-% (min: 21 w-%, max: 53 w-%) in 23 weeks
 - \emptyset 1.7 w-% per week



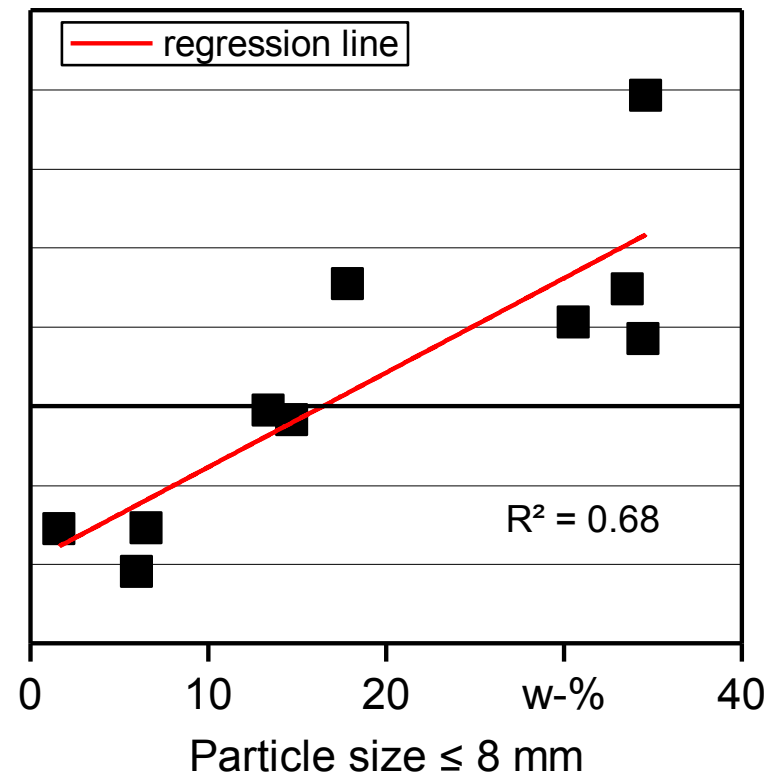
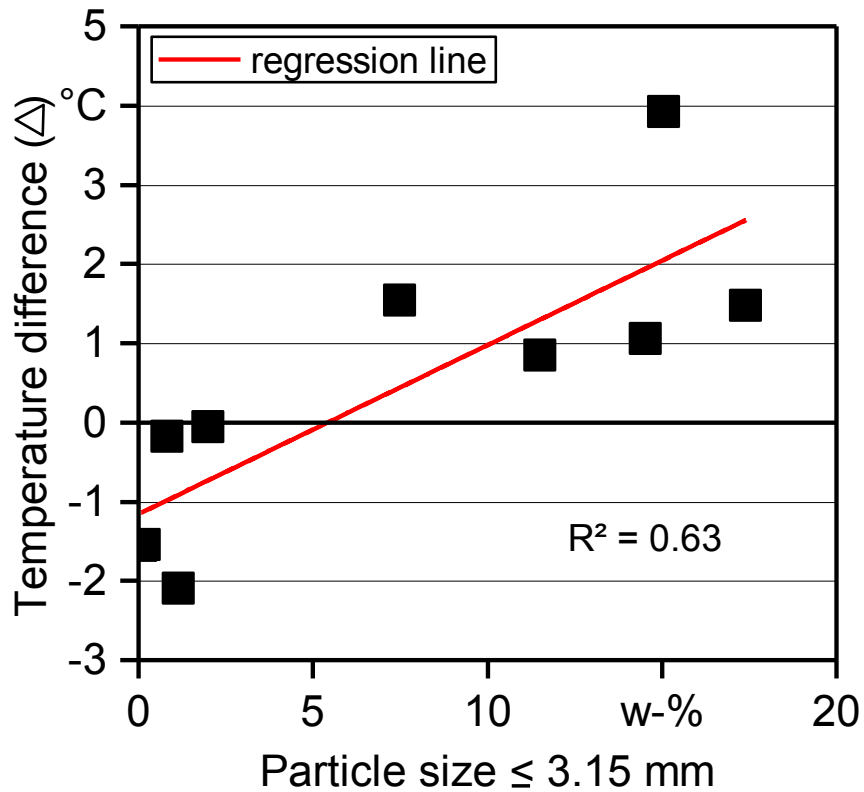
Results

Wood chip temperature, °C



Results

- Temperature difference, Δ ($T_{\text{wood chips}} - T_{\text{ambient air}}$) °C



Results

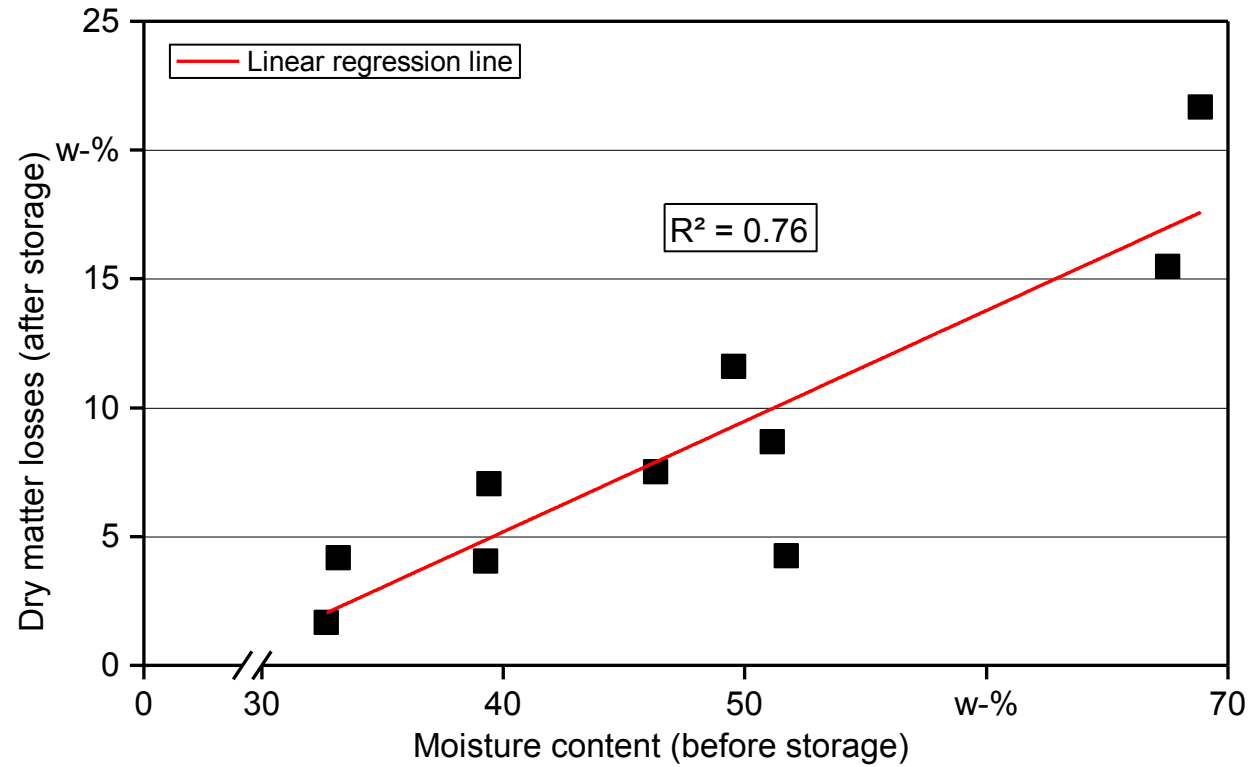
Assortments		Moisture content after storage, w-% (Δ abs.)	T max., °C	Δ T, °C	Dry matter losses, w-%
FRC - coniferous	unscreened	25.9 (-23.7)	38.3	3.9	11.6
	screened	19.3 (-27.0)	33.8	-0.2	7.5
ERC - spruce	unscreened	30.4 (-20.8)	31.9	1.5	8.7
	screened	27.9 (-23.8)	27.6	-1.5	4.2
ERC - beech	unscreened	19.3 (-20.2)	39.1	1.5	7.0
	screened	16.2 (-23.1)	27.3	-2.1	4.0
FRC - deciduous	unscreened	19.7 (-13.5)	34.8	1.1	4.2
	screened	16.1 (-16.6)	27.6	-1.6	1.7
SRC - poplar	unscreened	49.1 (-19.8)	33.0	0.8	21.7
	screened	41.3 (-26.2)	33.0	-0.1	15.5

Screened wood chips:

- better drying *
- smaller temperature development
- smaller dry matter losses

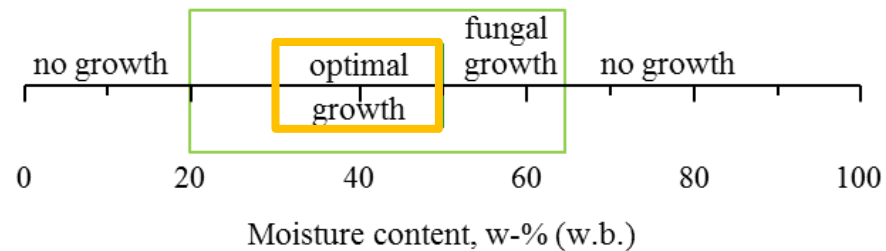
* $p \leq 0.05$ Student's tTest

Results



Results

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Comparison to field trials

- FRC and ERC were the same wood chips as used in summer trials (*Part 1*)
- Storage time and duration were almost identical
- Largest differences:
 - Wood chip volume ($< 1 \text{ m}^3 \Leftrightarrow 200 \text{ m}^3$)
 - Temperature development
 - Fleece \Leftrightarrow Outdoor shelter
- However: Similarities in drying and dry matter losses



Parameter		Container trial (unscreened)	Field trial (covered with fleece)
Dry matter losses, w-%	FRC	11.6	11.1
	ERC	8.7	6.9
Change in moisture content, w-% (absolute)	FRC	-23.7	-22.6
	ERC	-20.8	-22.2

Summary & conclusion

- Screening lead to **better drying** and **smaller dry matter losses**
- Container trials had reached **similar levels compared to field trials** under practical conditions in summer
 - Containers trials could be an **applicable & relevant low cost method** to assess storage properties of various fuel treatments and drying stages
- **Removal of 10 - 30 w-%** material by screening process
 - Screening is only profitable if there is a further use for the fine fraction or if higher fuel prices of the screened material may compensate for this loss
- **There is a need for further investigation concerning the effectiveness & profitability of screening processes in large storage piles**

Thank you for your attention!

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