



# Alternative plant fibres in paper and paper board

Pekka Saranpää, Risto Korpinen and Eila Järvenpää, Luke  
Päivi Viitaharju and Ulla Häggblom, TAMK  
Saija Malila, Design Forum Finland



# Hook

- Sustainable, biomass based packaging material saves energy, resources and reduces food loss
- Supports circular economy
- Improves brand value of manufacturer by novel packaging solutions



# Need

- Create sustainable, natural fibre based functional food packaging
- Added value to side streams from food production which are used for bionergy
- Future trends, urbanisation, consumer awareness, food delivery, internet sale



# Approach

- New solutions for improved eco deluxe food packaging, delivery, holistic benefit for whole production chain from agriculture to brand owners
- Sustainable raw materials, biodegradable products
- Co-operation network: Luke, TAMK, Design Forum: combined excellence in biomaterial science, paper and paper board making and packaging design.



# Benefits

- Agropaper produced with 20...30% grain hull content (basis weight equal to pure pulp) saves wood and forests and thus, advances raw material efficiency, cascade use and circular economy.
- Oat hulk for bioenergy production costs ca. 35 € / ton. Cf. Pulp price is ca. 800 € / ton.
- Products could be marketed in packaging in which side products have been efficiently utilised



In year 2021 the production of oat was 783 million kg in Finland  
The hull content is 23 – 30 %.

# Competition

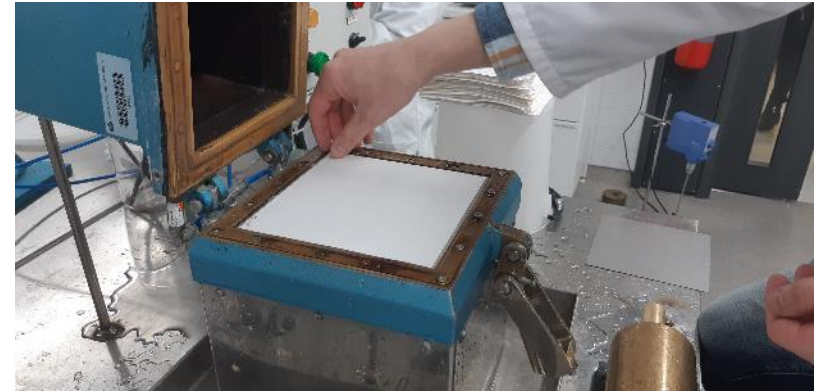
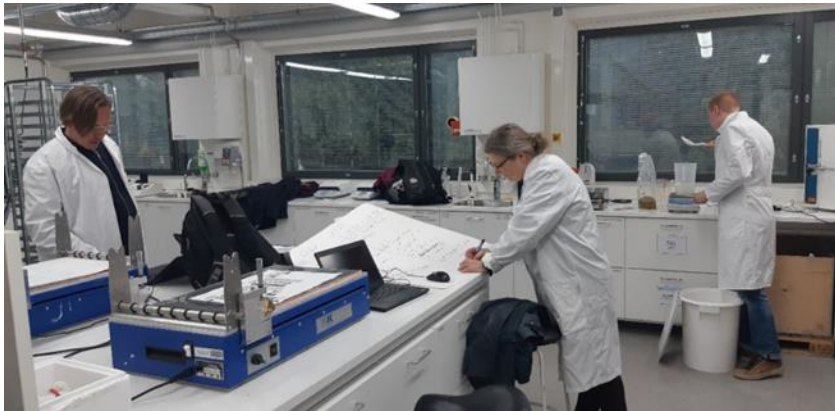


Veuve Clicquot uses grape-based paperboard for its secondary packaging



GreeNest - innovative egg packaging made with grass fibers

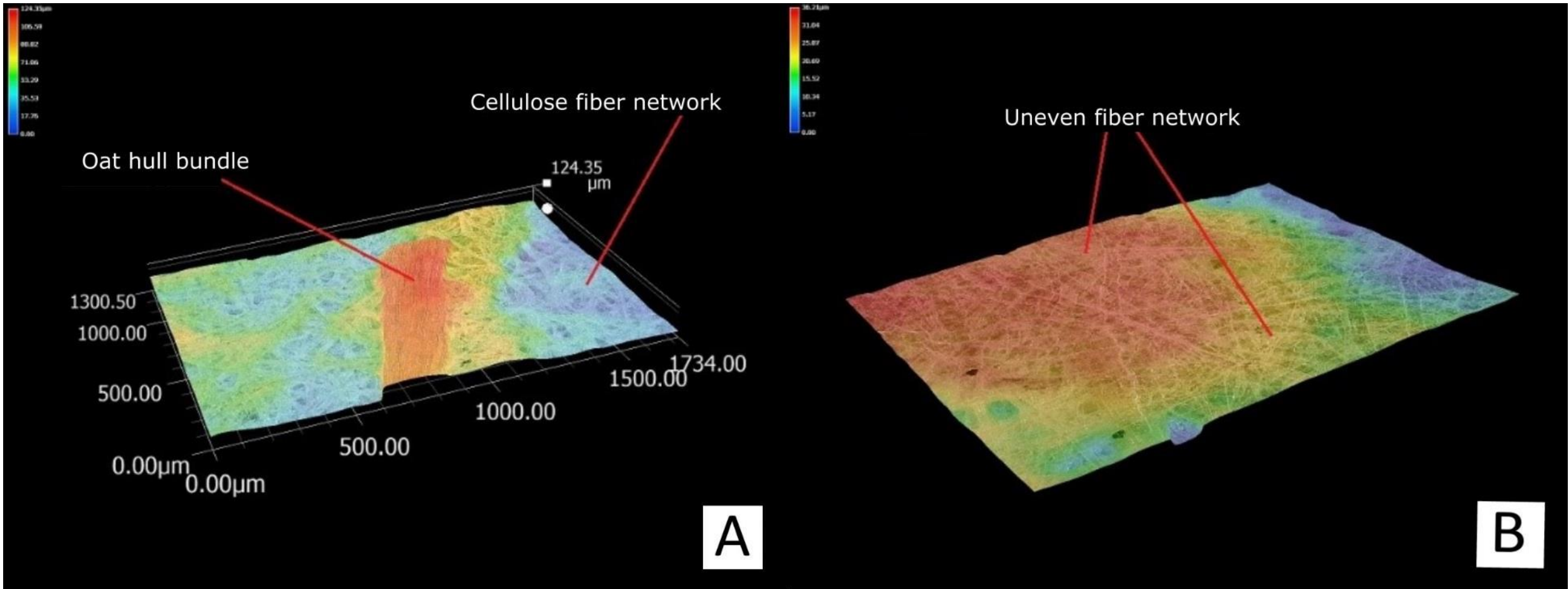




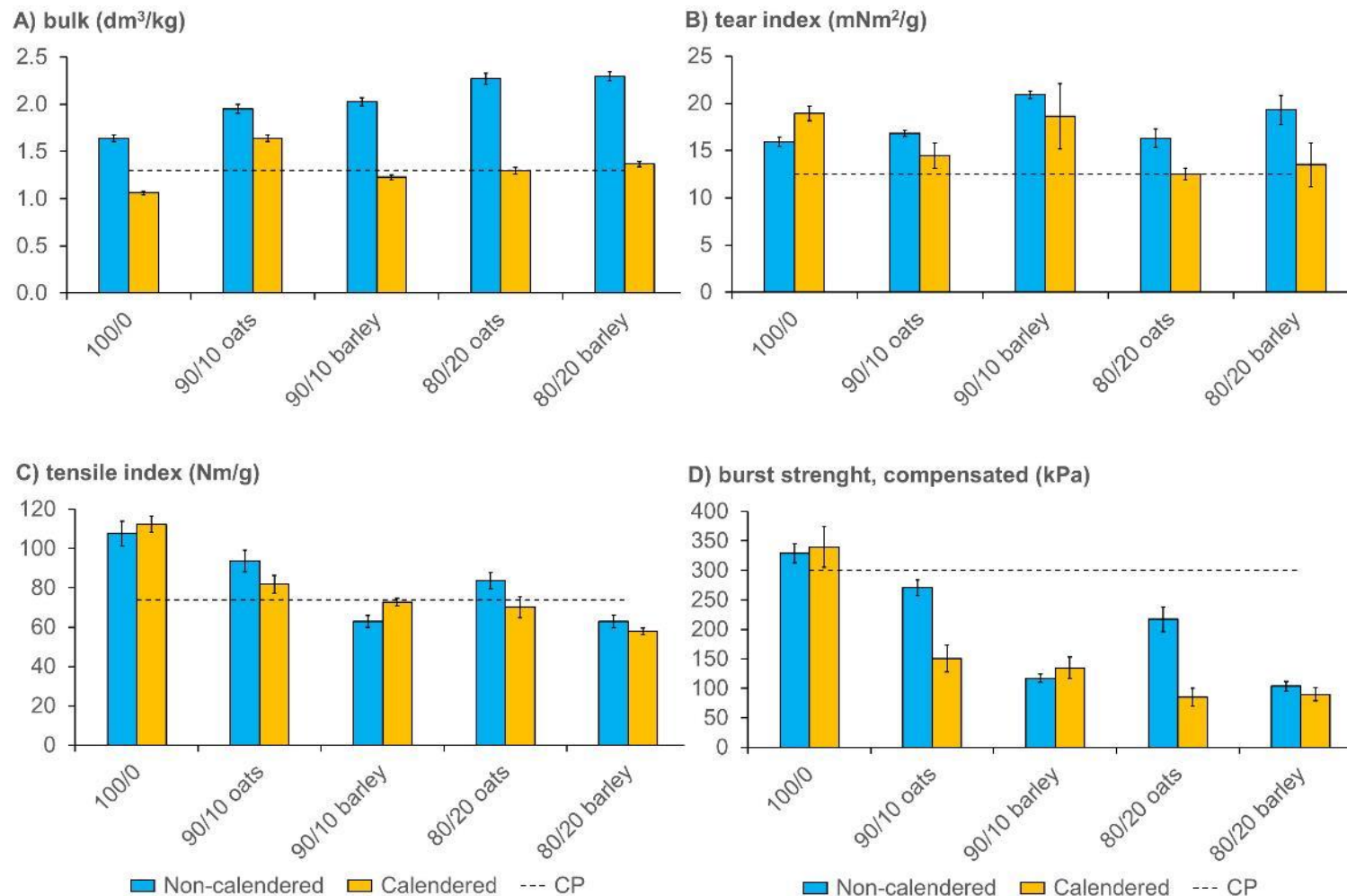


# Visually attractive paper for packaging





Fibre structure of a non-calendered (A) and calendered (B) paper sheet. A calender is a series of hard pressure rollers used to finish or smooth a sheet of paper.



Paper technical properties of non-calendered and calendered laboratory sheets with oat and barley hulls. Dotted line is the reference paper, CP = commercial paper with similar grammage (Mondi Group, 2021).





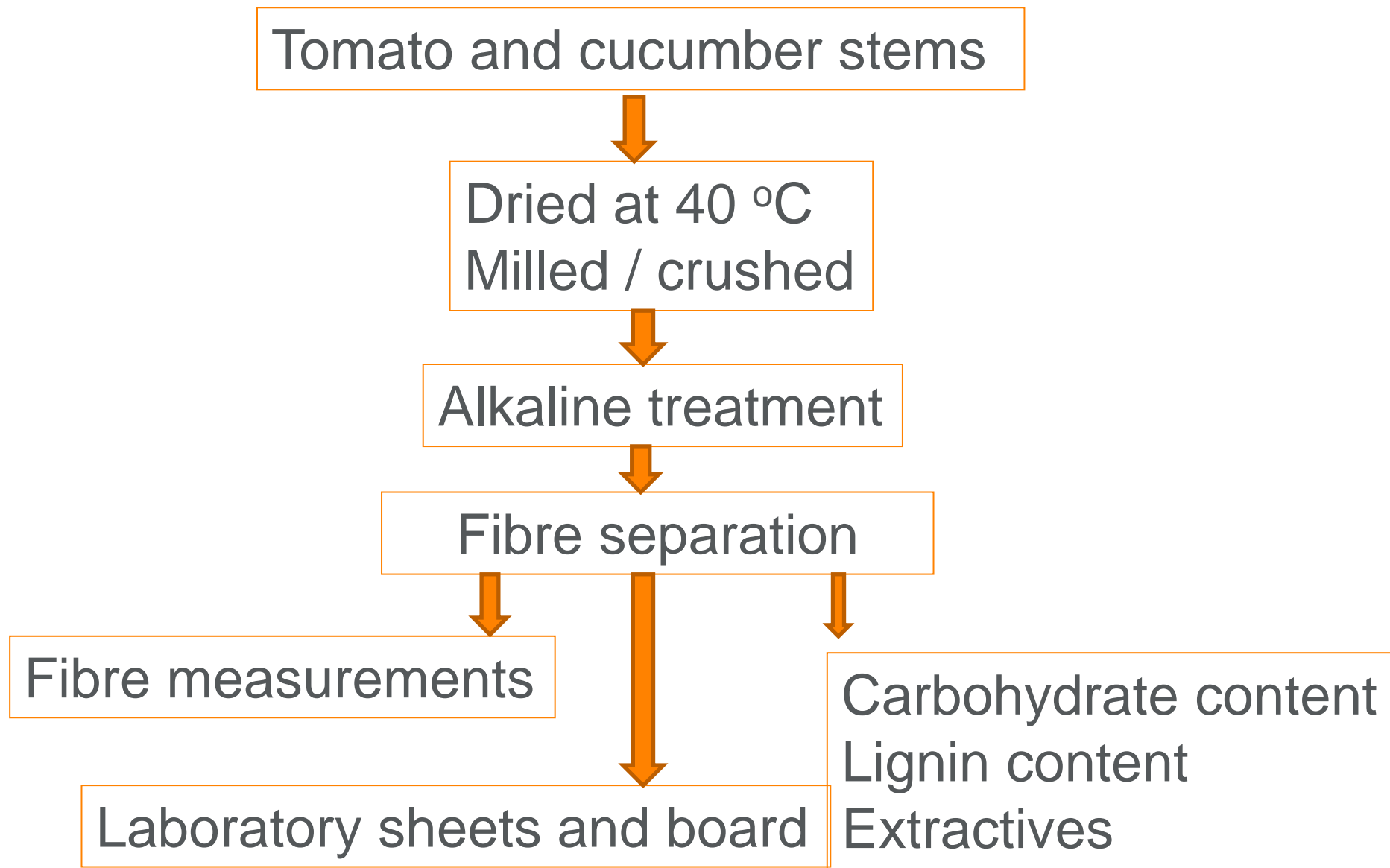
VIRGIN AND RECYCLED  
PULP FIBRES

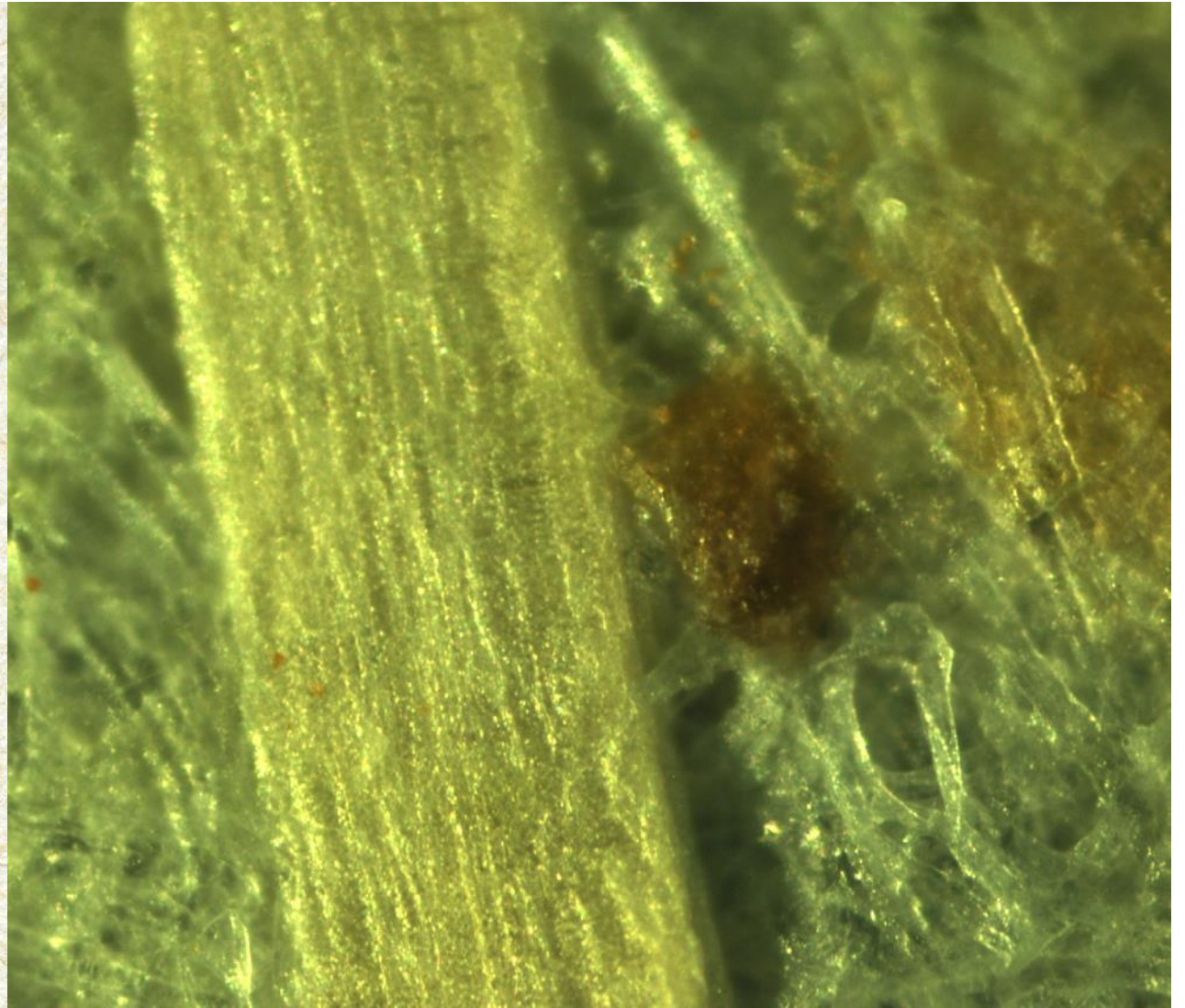
FIBRES FROM SIDE  
STREAMS OF  
HORTI-CULTURE



Tomato and cucumber stems

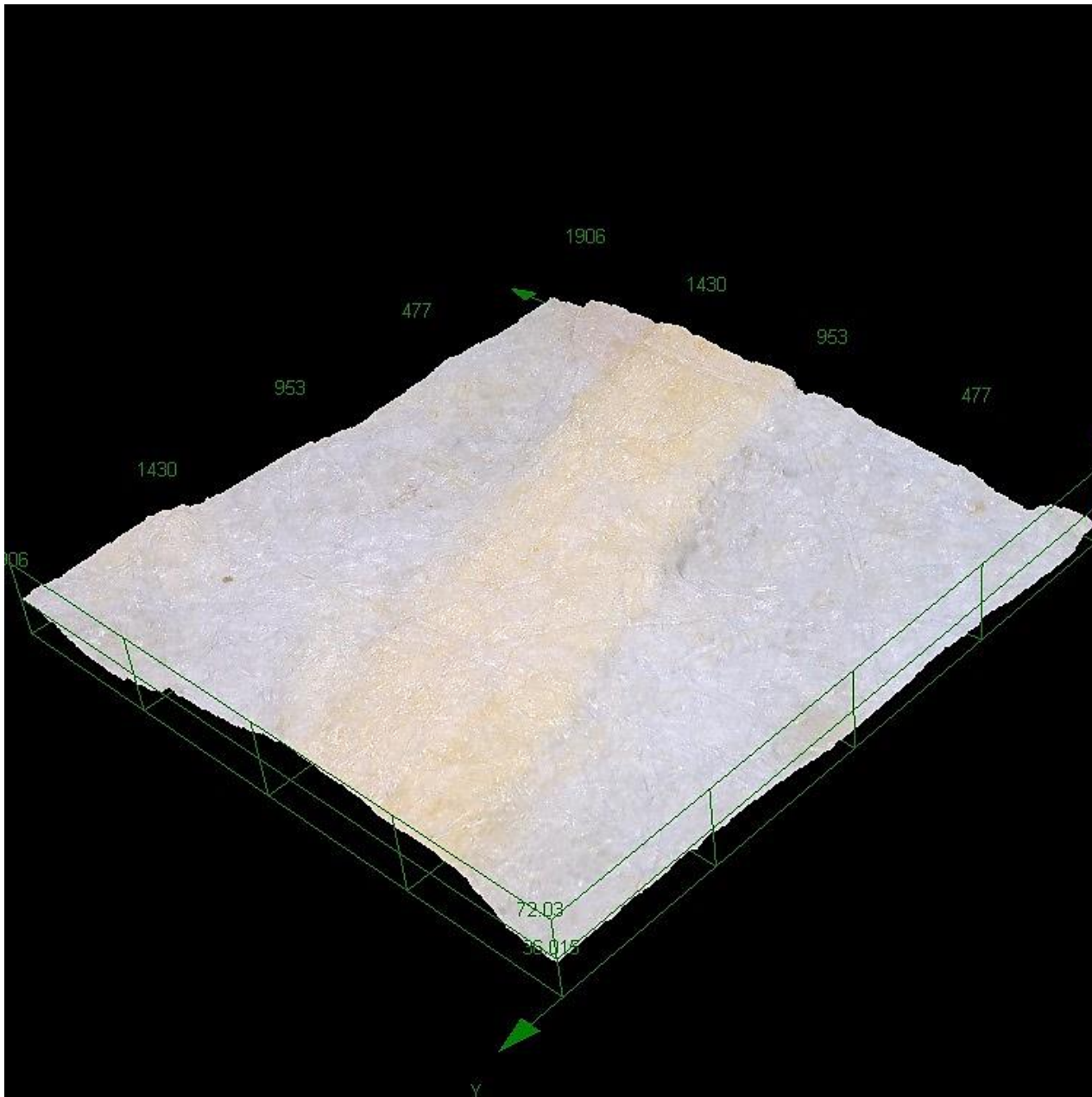






Paper with cucumber stem fibre bundles. Calendered sheet.





Paper with cucumber stem fibre bundles. Calendered sheet. Showed improved fracture stiffness compared to pure softwood fibre paper.

# Conclusions

- Oat fibers were observed to be slightly longer than those of barley ( $0.80 \pm 0.19$  mm and  $0.51 \pm 0.17$ , respectively).
- To achieve fibrillation beneficial for the papermaking, oat and barley hulls were refined with a disc refiner. Oat hulls were observed to be harder than barley hulls.
- Hull-containing paper mostly met the same quality requirements as the commercial paper except for the burst strength in sheets containing either species' hulls, and the tensile strength in sheets containing barley hulls.

# Thank you!





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Natural Resources Institute Finland  
(Luke)  
Latokartanonkaari 9, FI-00790 Helsinki

