Välkommen till

E-kol-ogiskt!

presentation av projektresultaten

Presentation held on the 20th November 2019 in Roma Lövsta and on the 21st November 2019 in Visby, Gotland, Sweden

Lokalt ledd utveckling LEADER GUTE

Europeiska jordbruksfonden för landsbygdsutveckling: Europa investerar i landsbygdsområden

SLU Sveriges lantbruksuniversitet Swedish University of Agricultural Sciences

GOTLAND Grönt Centrum

STENHUSE GÅRD

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Degreed Engineer for
Landscape Management & Nature Conservation

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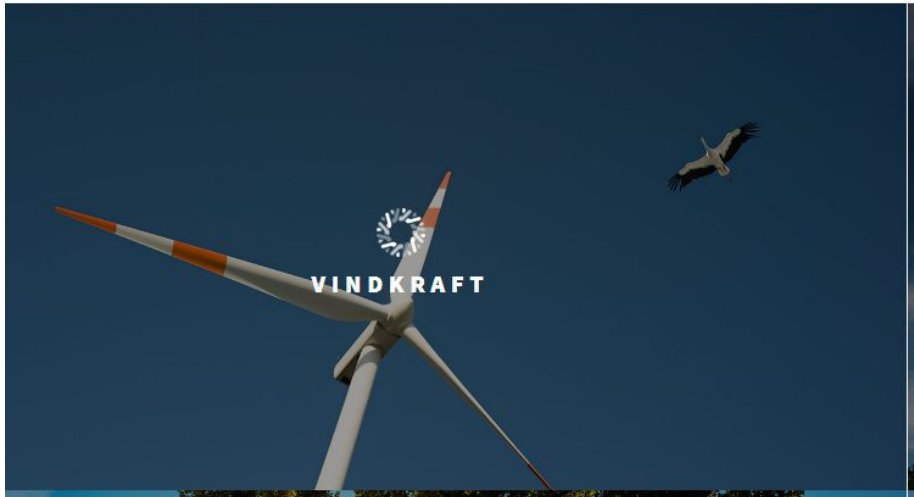
Waila AB

Waila is a word of Gothic origin which means “in a good manner”. This mirrors our desire to utilize our creative power to make a real contribution to environmental and nature protection.

A significant net removal of carbon dioxide from the atmosphere is the ambition for our business activities.



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The project E-kol-ogiskt!

Goal

demonstrate beneficial impacts of biochar-substrates on

- soil fertility (focus: nitrogen storage, carbon storage, harvest)
- water management (focus: water storage capacity)
- climate change (focus: carbon sequestration)

Setup

a field trial on a asparagus plantation to analyse:

- the difference between biochar application and control
- compare two different, nitrogen loaded biochar-substrates
- compare different biochar concentrations

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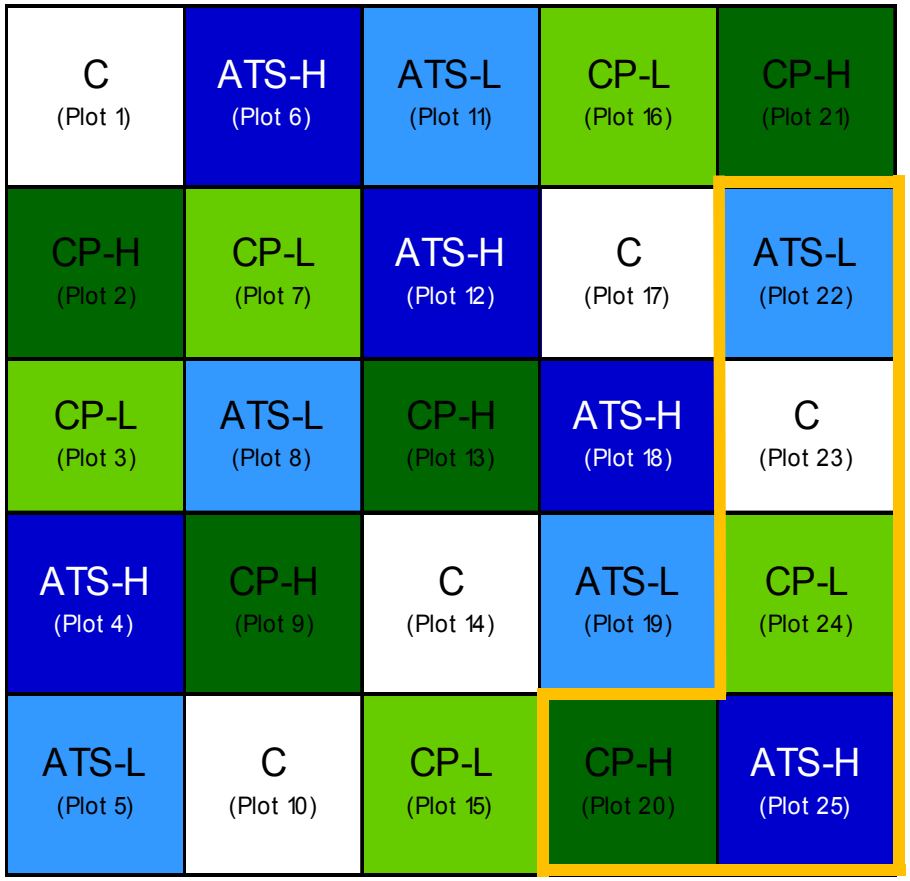
Trial Design

- 77 x 75m (0,58 ha)
- double-randomized Latin square
- 5 variants, 5 repetitions
- biochar concentrated along the asparagus rows
- <u>Planned</u>
  - 2,5 t (1,25) t /ha biochar (dry mass)
  - equal nitrogen input to variants C, ATS-H, CP-H
- <u>Realized</u>
  - As planned for C, CP-L and CP-H treatments
  - 59% more substrate (carbon, nitrogen, etc.) on ATS-L and ATS-H treatments as planned

  => 4,0 t (2,0) t /ha biochar (dry mass) on ATS-H (ATS-L) treatments



sandy plots

<u>Variants</u>:
C: control; ATS: biochar mixed with vinasse, molasses and effective microorganisms (ATS-H: High application, ATS-L: Low application); CP: biochar mixed with cattle manure and water (CP-H: High application, CP-L: Low application)

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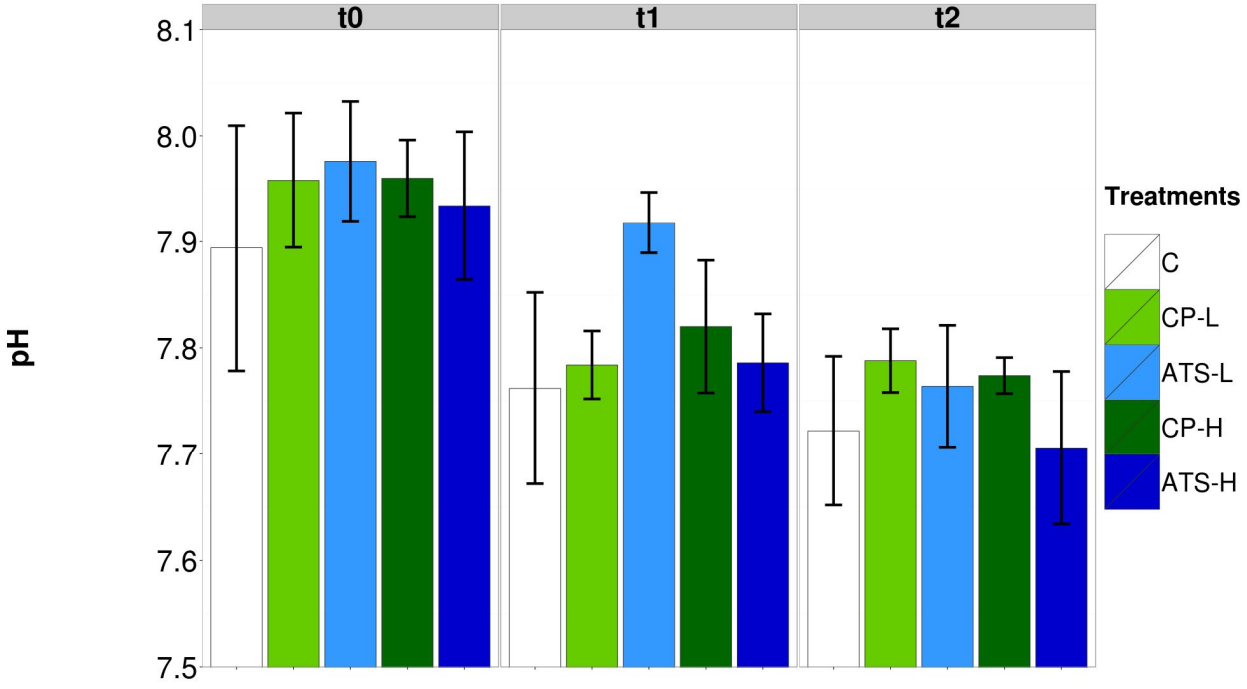
Soil fertility




pH (averages for 5 x 5 plots)



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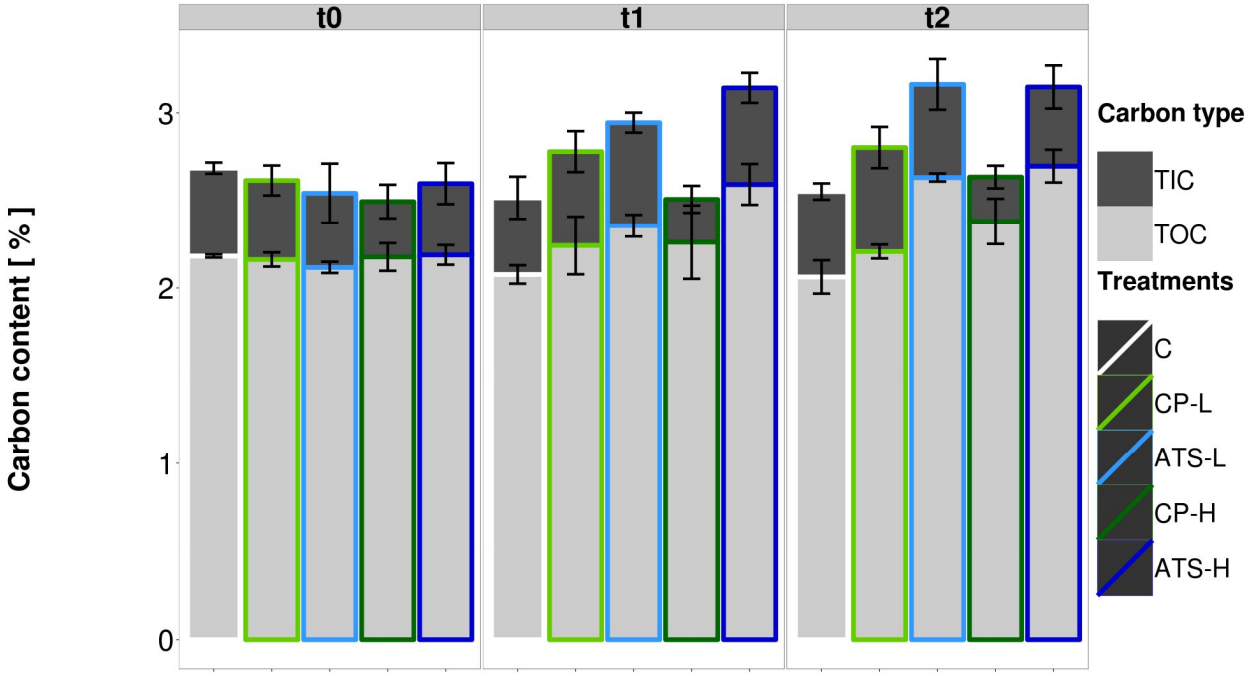
Soil organic carbon content (averages for 5 x 5 plots)



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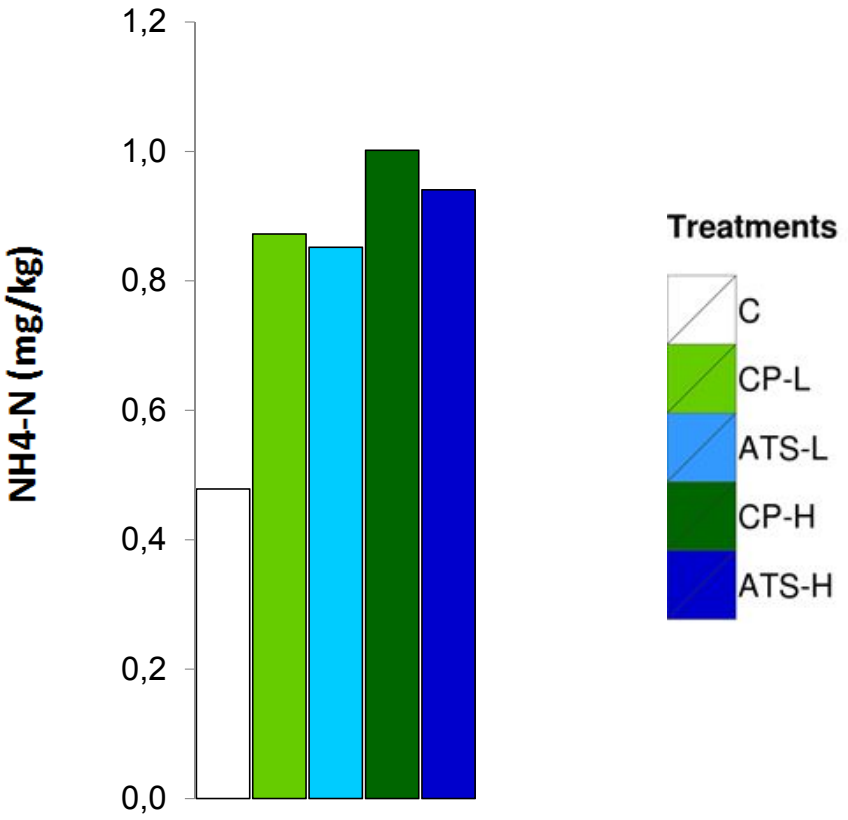
Soil NH4-N content (mg/kg) (averages for 5 x 5 plots)



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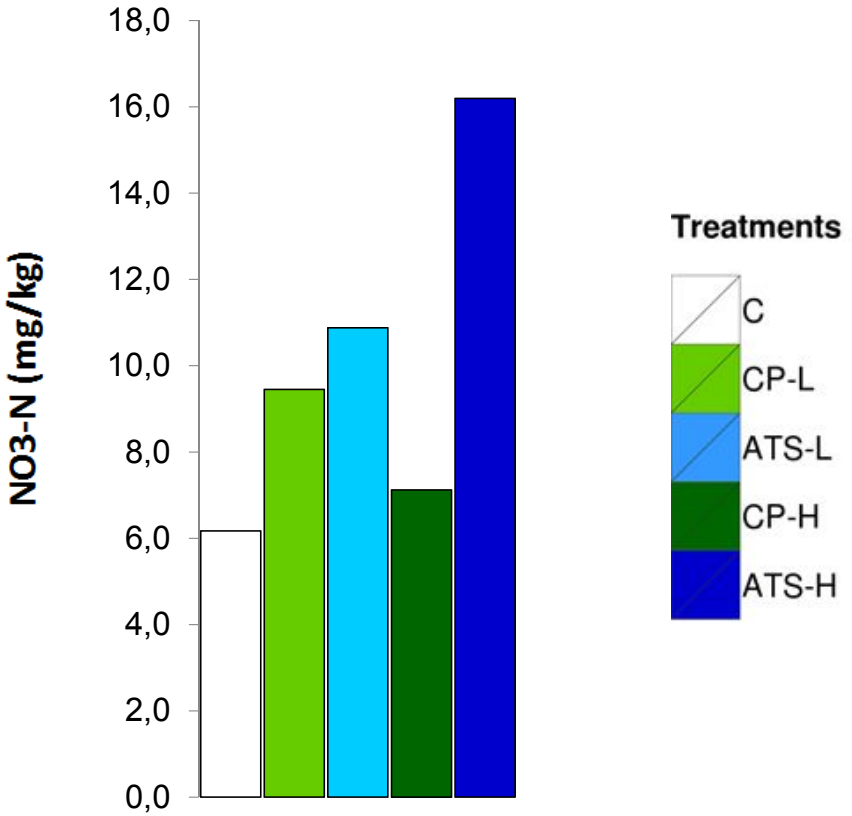
Soil NO3-N content (mg/kg) (averages for 5 x 5 plots)



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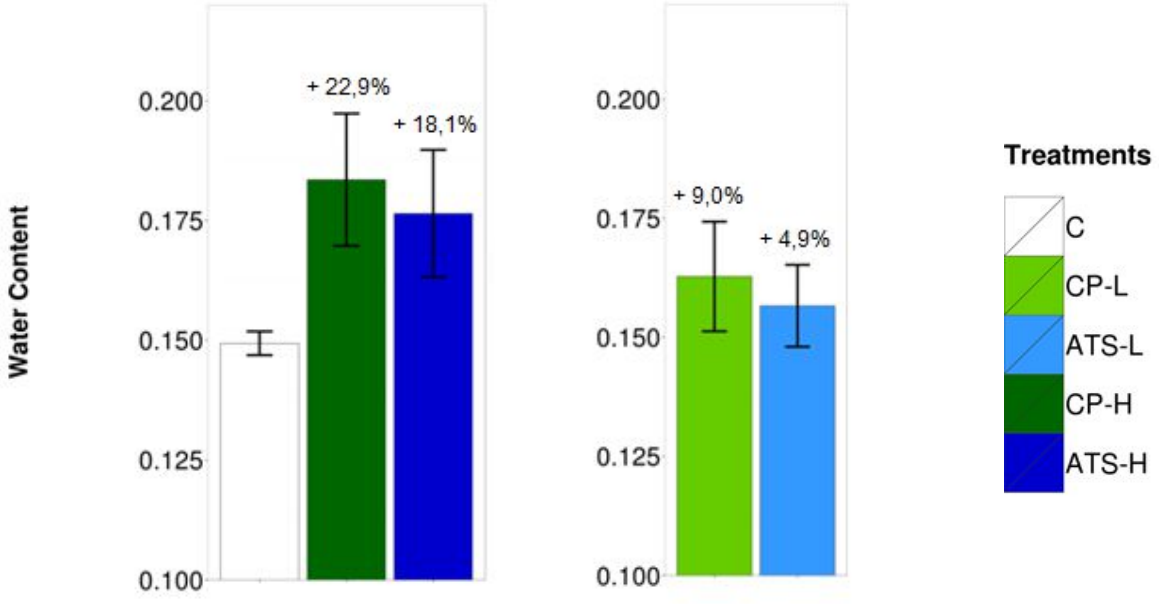
Soil water content (averages for 5 x 5 plots)



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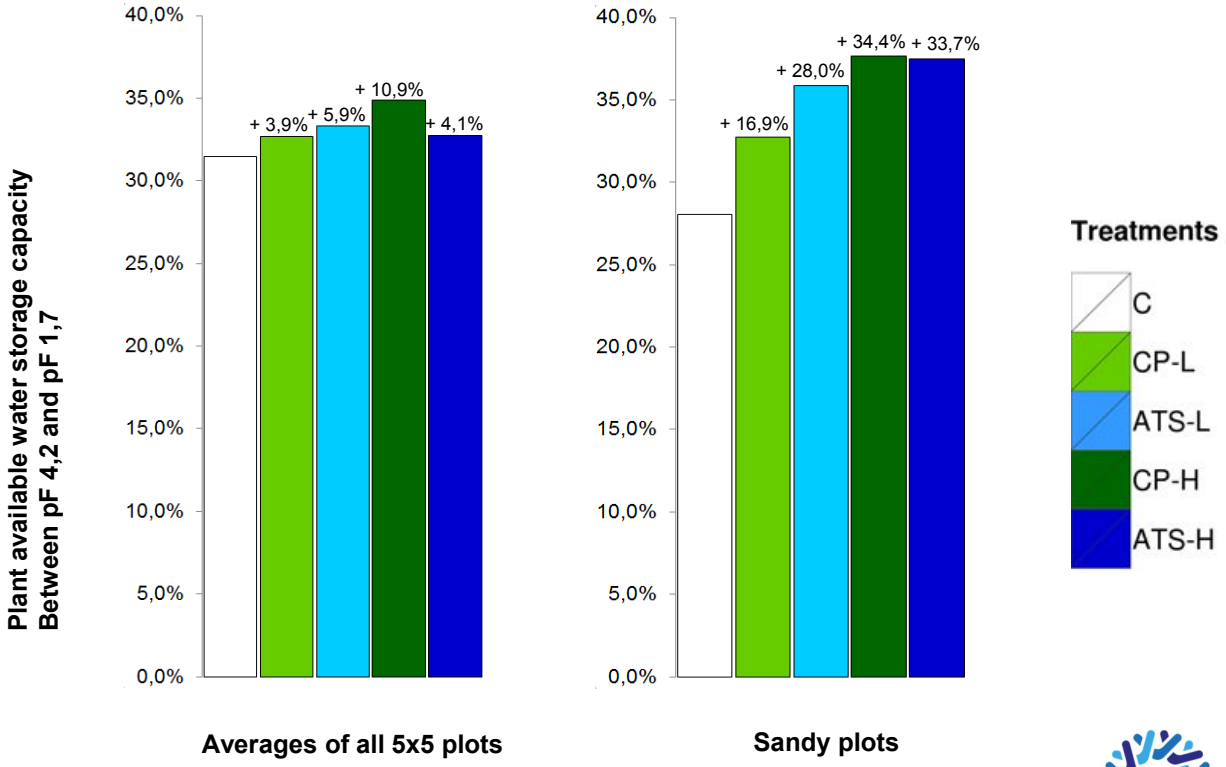
Soil water storage



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Harvest

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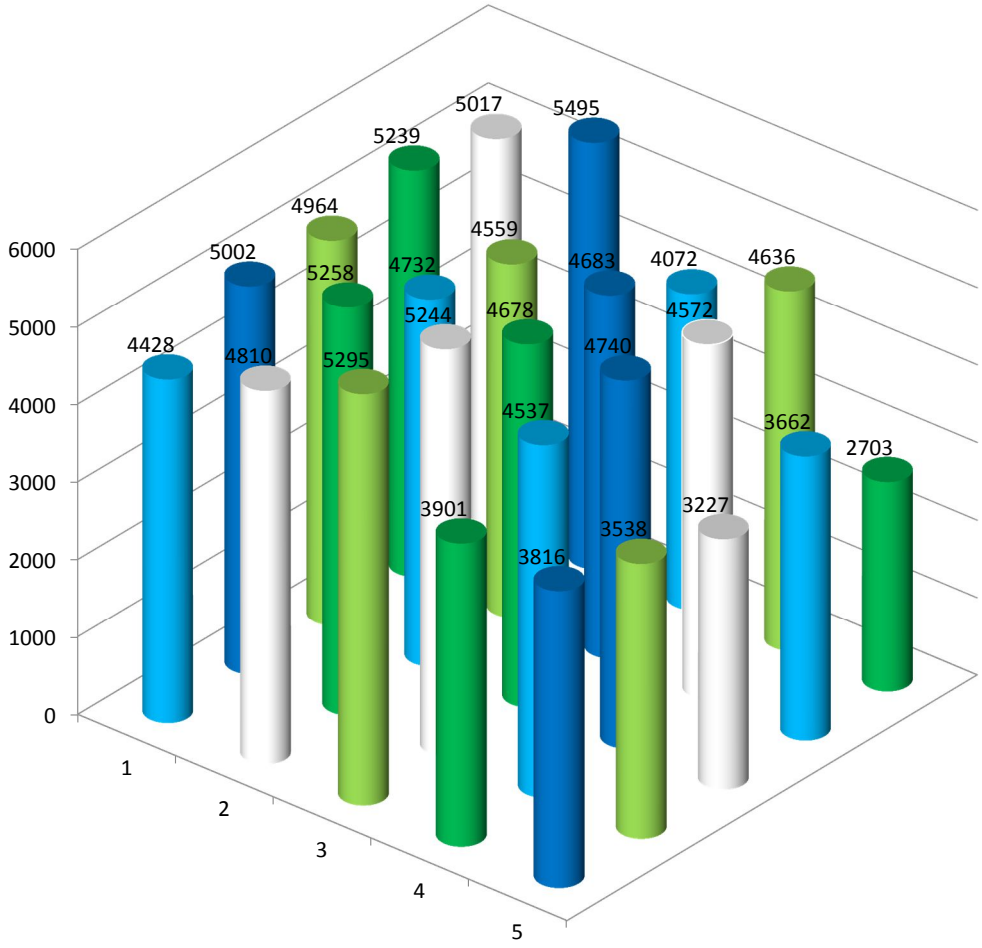
Yield distribution
(above-ground biomass, gram per plot)



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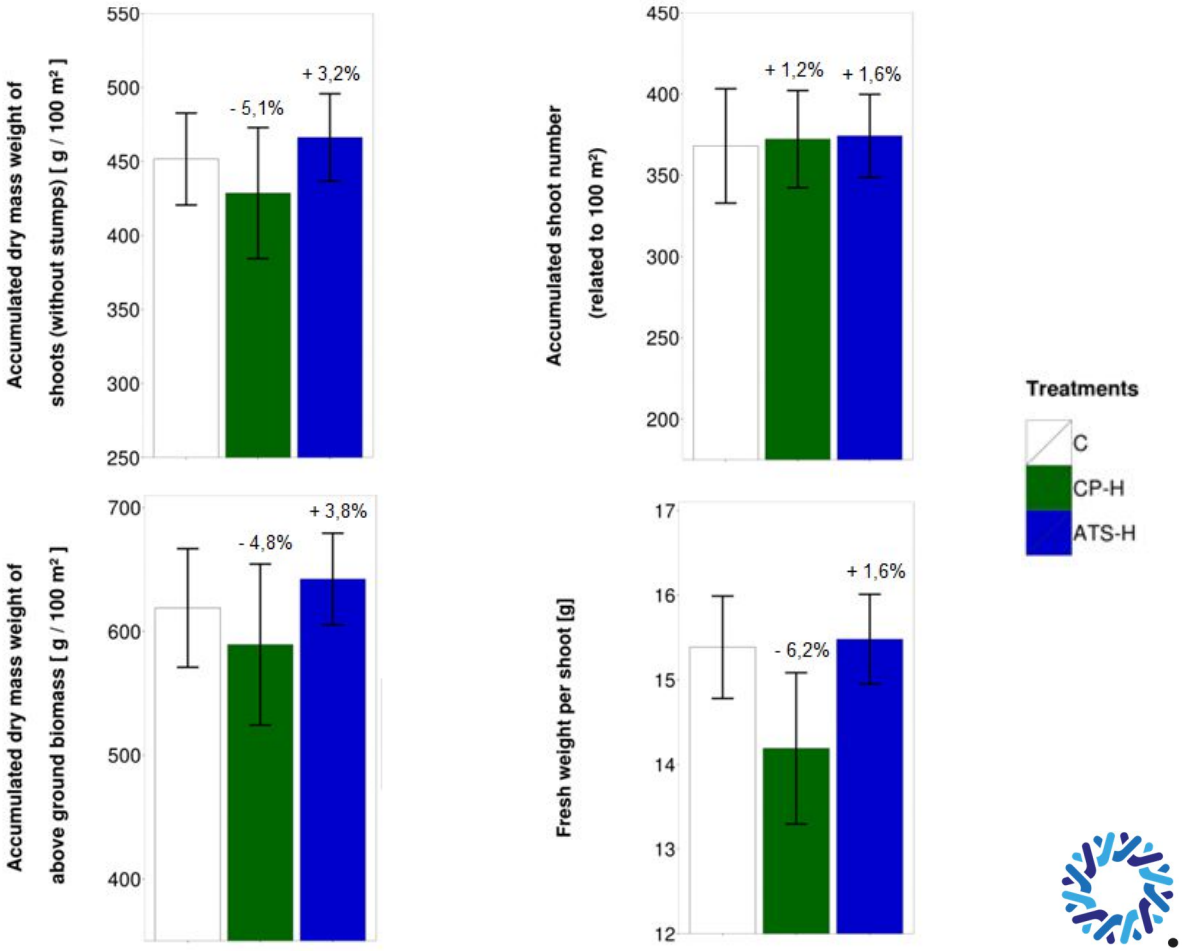
Yield (average of all 5x5 plots)



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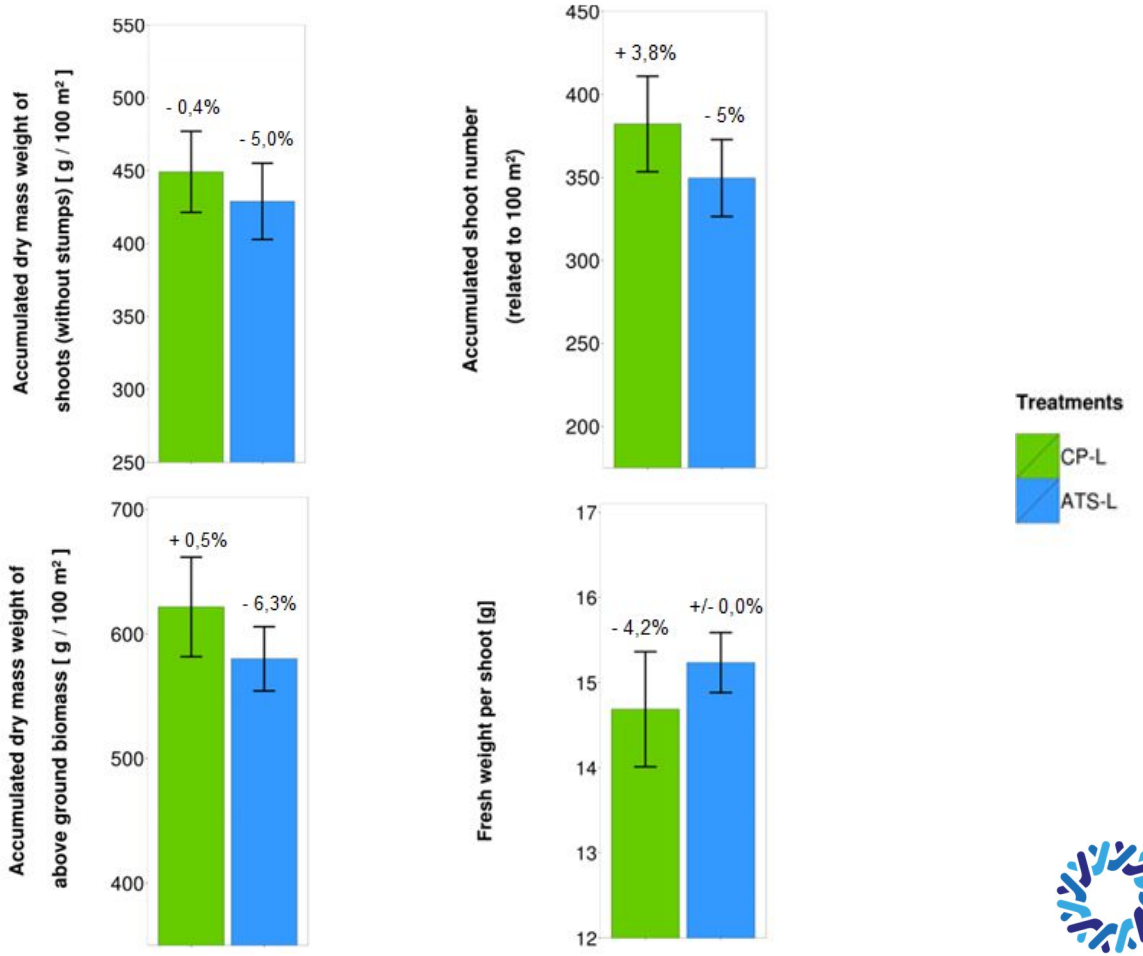
Yield (average of all 5x5 plots):



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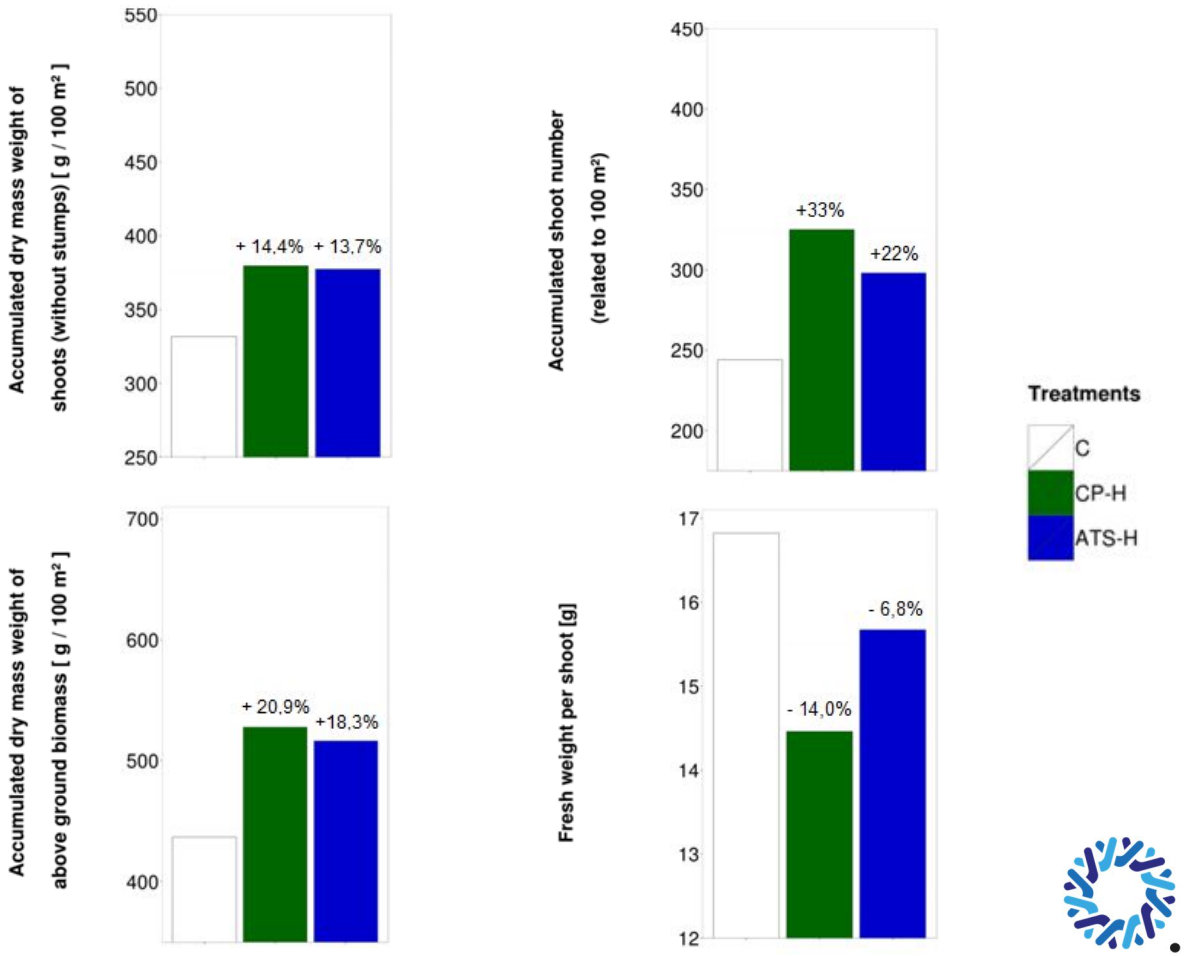
Yield (5 sandy plots):



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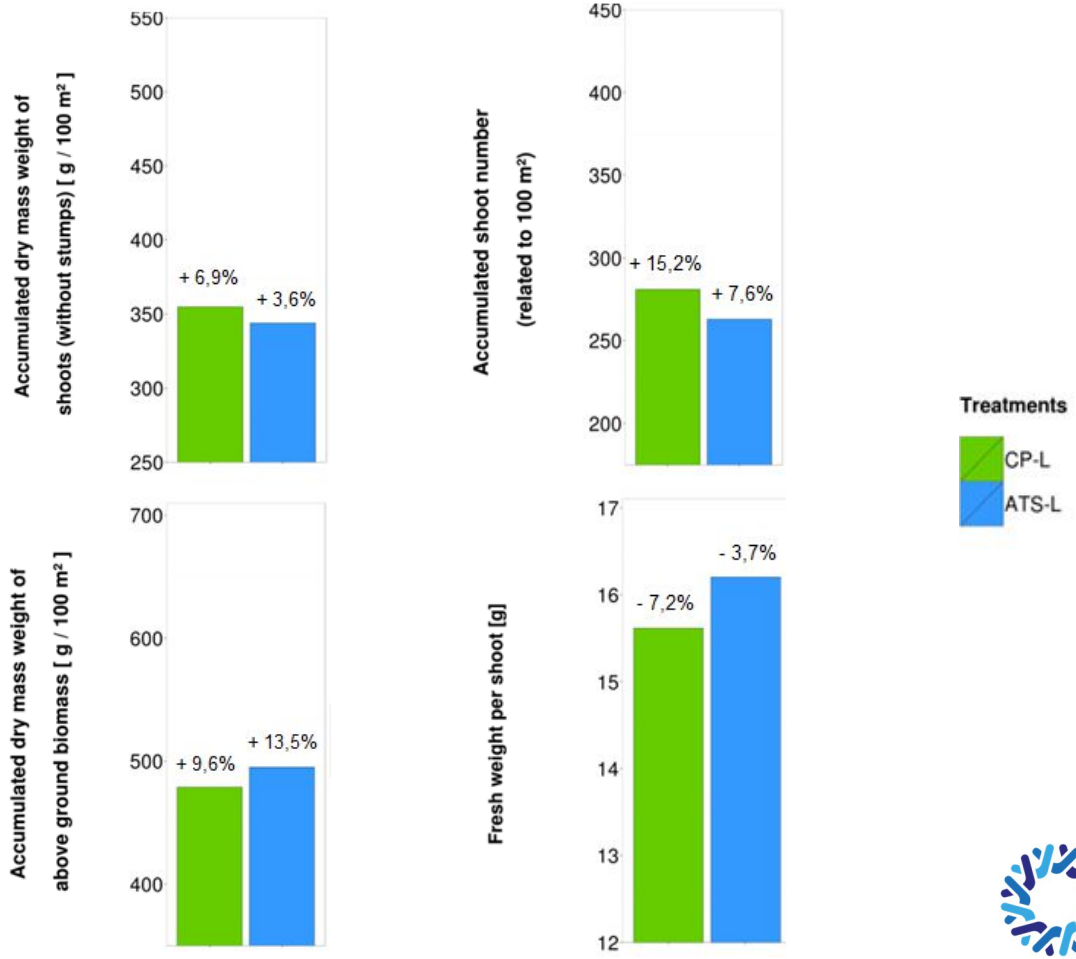
Yield (5 sandy plots):



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Climate impact of asparagus production with biochar

Factor	Unit	Source
Positive climate impact of biochar production and application in the field trial	-7,6 kg $CO_{2eqv.}$/ kg asparagus	Calculation with data from Stenhuse Gård (2019), Meyer et al. (2012) and Waila (2019)
Average GHG emissions of asparagus production	0,9 kg $CO_{2eqv.}$/ kg asparagus	ETH Zürich (2016)
Net positive climate impact of biochar application at field trial	**- 6,7 kg $CO_{2eqv.}$/ kg asparagus**	

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Economical Assessment

Källa: Facebook sida Stenhuse Gård

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Economical Assessment (for CP-H treatment on sandy soils, 10 years)

Benefit / Cost	SEK	Unit	Assumptions
Benefits			
Revenue Increase Asparagus	11.570	SEK /ha*year	Yield increase: 14,4% (Baseline:650 kg/ha)
Nitrogen Fertilizer Savings	272	SEK /ha*year	25% nitrogen saving
Value Increase Farm Land	364	SEK /ha*year	Increase soil C-org: 0,1%
Carbon Storage	183	SEK /ha*year	7t CO_2 sequestered, 270 SEK/t CO_2
Costs			
Biochar Substrate	3.065	SEK /ha*year	4,1 t FM biochar/ha
Biochar Application	80	SEK /ha*year	
Harvesting and Marketing	4.099	SEK /ha*year	Costs for asparagus yield increase
Surplus	50.692	SEK	Over 10 year period
Return-on-Investment	6,5	%	

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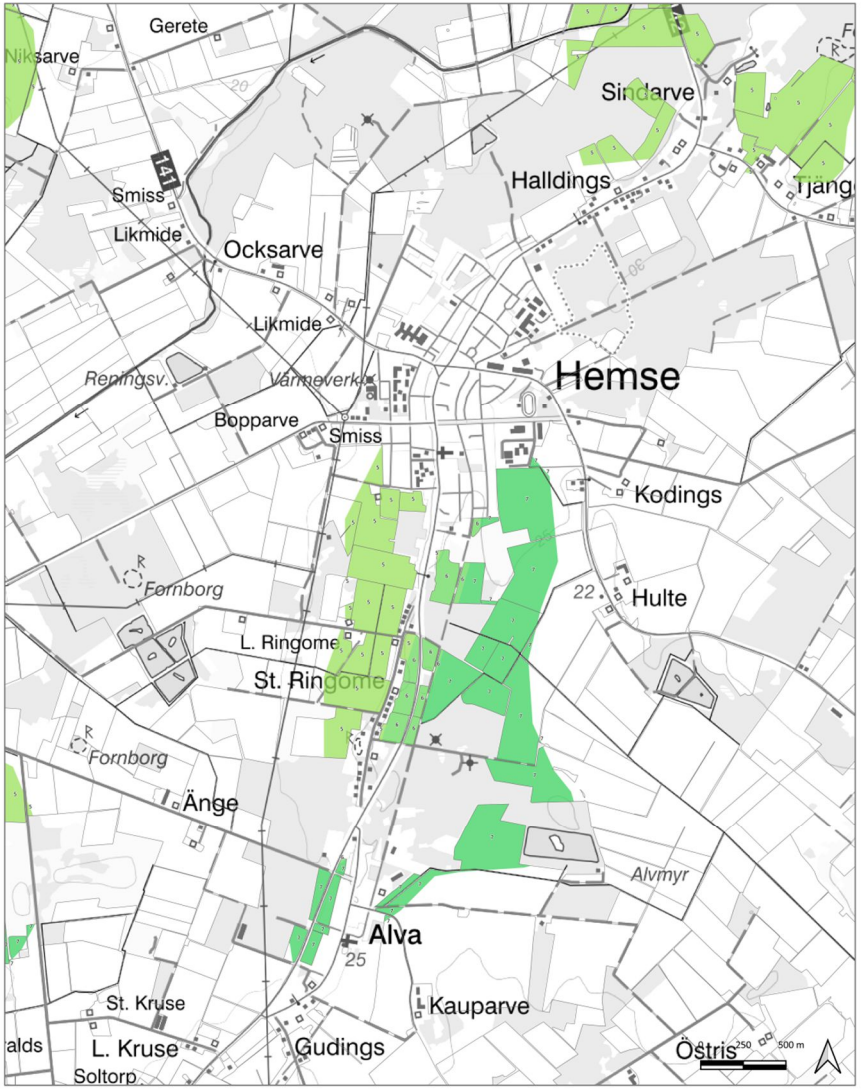
What about my farm land?

The Biochar Map for Gotland

- GIS analysis is a sub-project
- data from Swedish national authorities were combined
- map highlights those arable areas which will be most affected by **draught conditions** in the near future and should profit the most from an increase in the **nitrogen fertilizing efficiency**
- these areas are most appropriate for biochar application, since both the **water storage capacity and the nitrogen storage capacity of the soil can be improved**
- **26 % (23.000 ha)** of Gotlands arable land would benefit particular from biochar application according to the analysis
- https://waila.se/biokolkarta-gotland/



Karta: Lämplighet av Gotlands åkermark för biokolanvändning - GIS analys inom Leader Gute projektet "E-kol-ogiskt! - ett demonstrationsprojekt för biokolanvändning på Gotland", 2019

Summary

- Positive impact of biochar application on soil fertility:
  - Decrease in soil pH (and soil bulk density)
  - Improved NO3-N, NH4-N (and total N) storage
  - Increase in organic carbon content
- Positive impact on groundwater pollution with nitrate likely
- Less sandy soils: Yield increase for ATS-H treatment
- Less sandy soils: Yield decrease for manure-biochar treatment
- Sandy soils: Considerable yield increase for all biochar treatments (+3,6 % to +14,4%)
- We recommend to prevent manure putrefaction via early biochar addition or manure aeration
- Effective microorganisms might provide additional benefits for plant growth
- Profitable, climate-positive crop production possible

Let us turn Gotlands agricultural sector into a large scale carbon sink!

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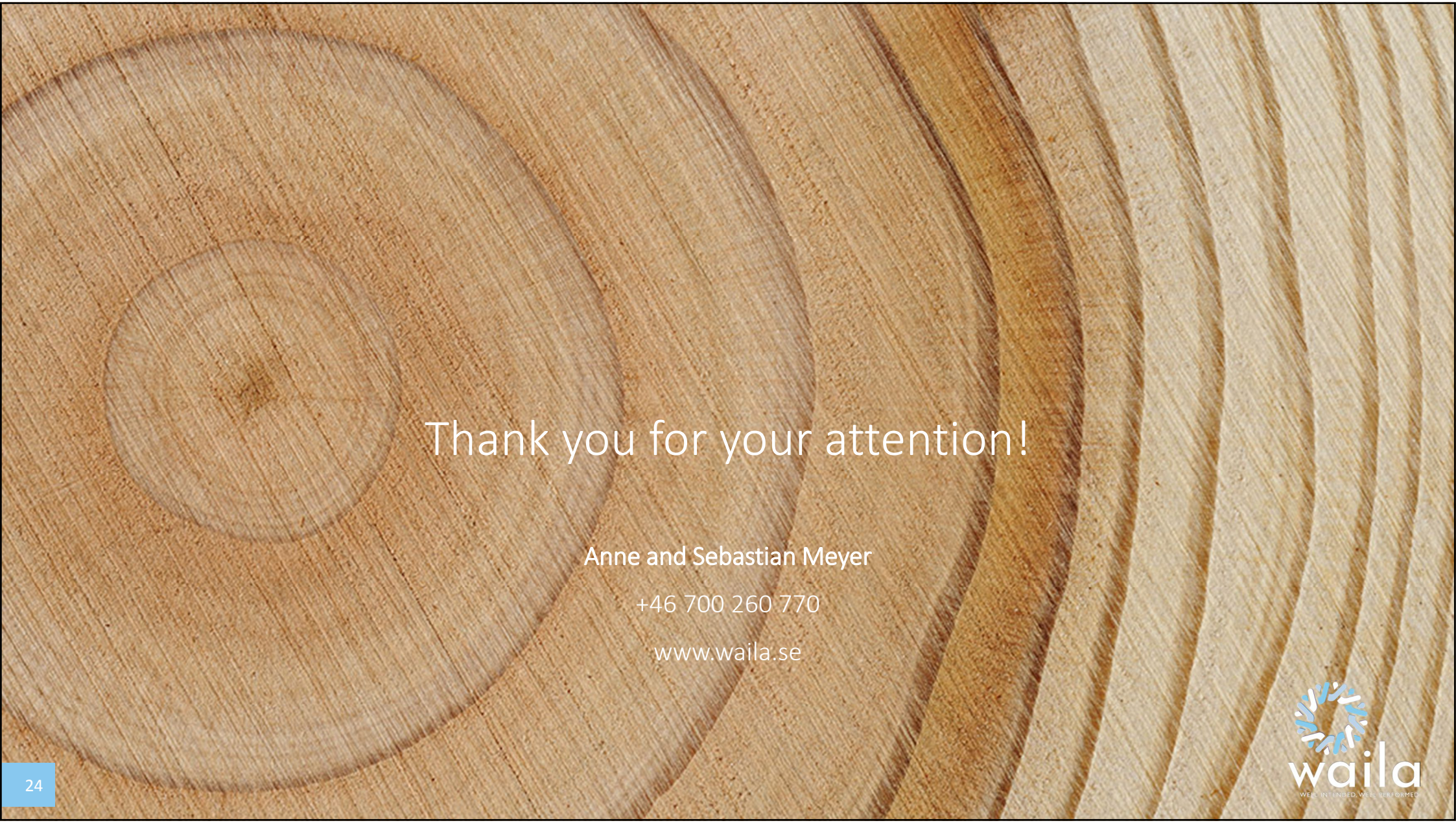
Thank you for your attention!
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