

Välkommen till

E-kol-ogiskt!

presentation av projektresultaten



Sveriges lantbruksuniversitet
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STENHUSE GÅRD

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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.







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

Trial Design

- 77 x 75m (0,58 ha)
- double-randomized Latin square
- 5 variants, 5 repetitions
- biochar concentrated along the asparagus rows
- Planned:
 - 2,5 t (1,25) t /ha biochar (dry mass)
 - equal nitrogen input to all variations
- Realized:
 - 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

C (Plot 1)	ATS-H (Plot 6)	ATS-L (Plot 11)	CP-L (Plot 16)	CP-H (Plot 21)
CP-H (Plot 2)	CP-L (Plot 7)	ATS-H (Plot 12)	C (Plot 17)	ATS-L (Plot 22)
CP-L (Plot 3)	ATS-L (Plot 8)	CP-H (Plot 13)	ATS-H (Plot 18)	C (Plot 23)
ATS-H (Plot 4)	CP-H (Plot 9)	C (Plot 14)	ATS-L (Plot 19)	CP-L (Plot 24)
ATS-L (Plot 5)	C (Plot 10)	CP-L (Plot 15)	CP-H (Plot 20)	ATS-H (Plot 25)

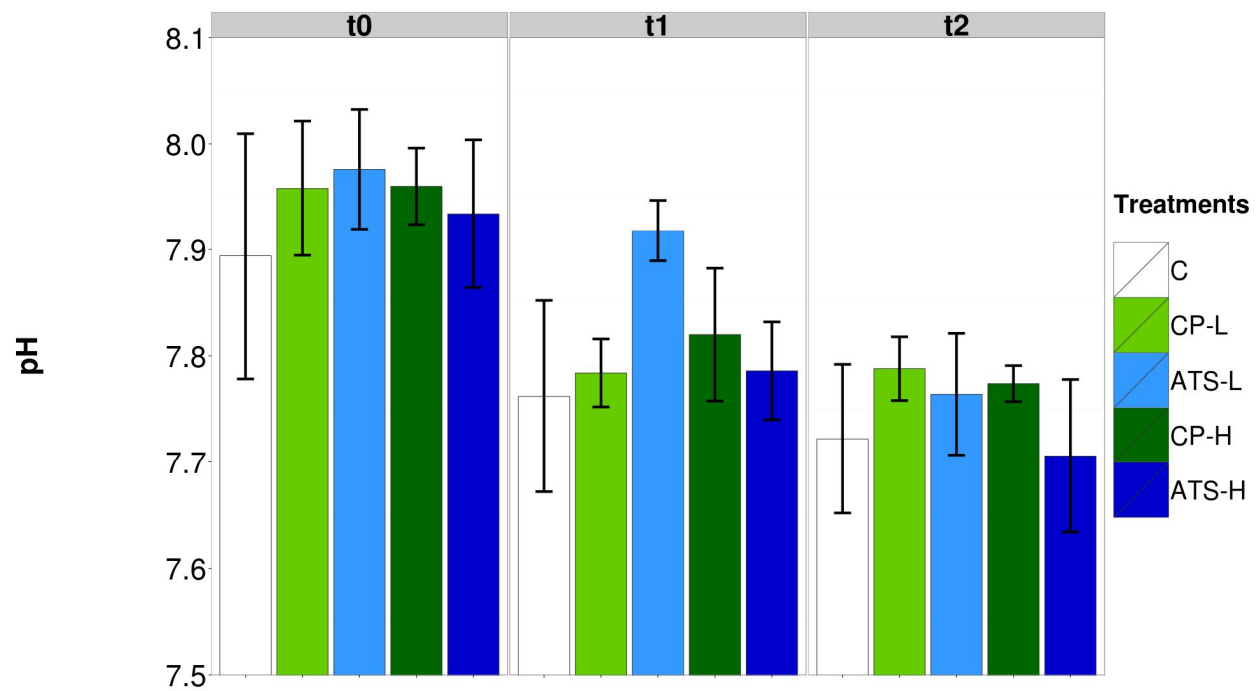
— sandy plots

Soil fertility



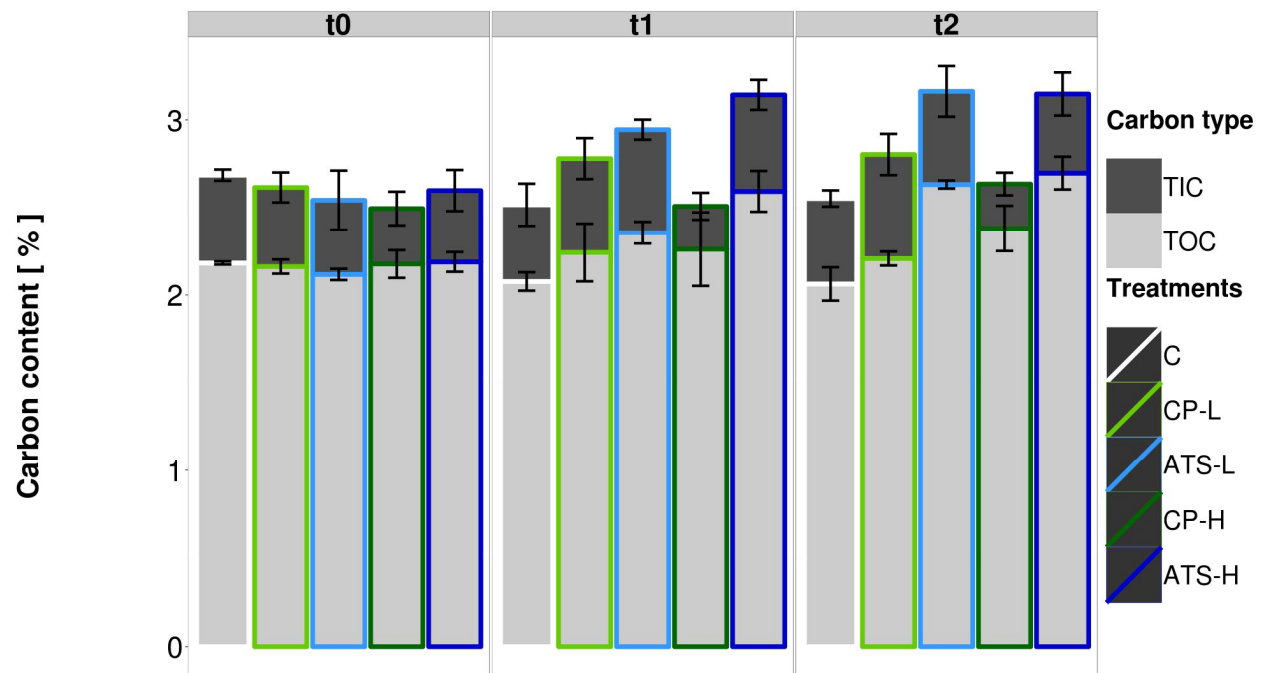


pH



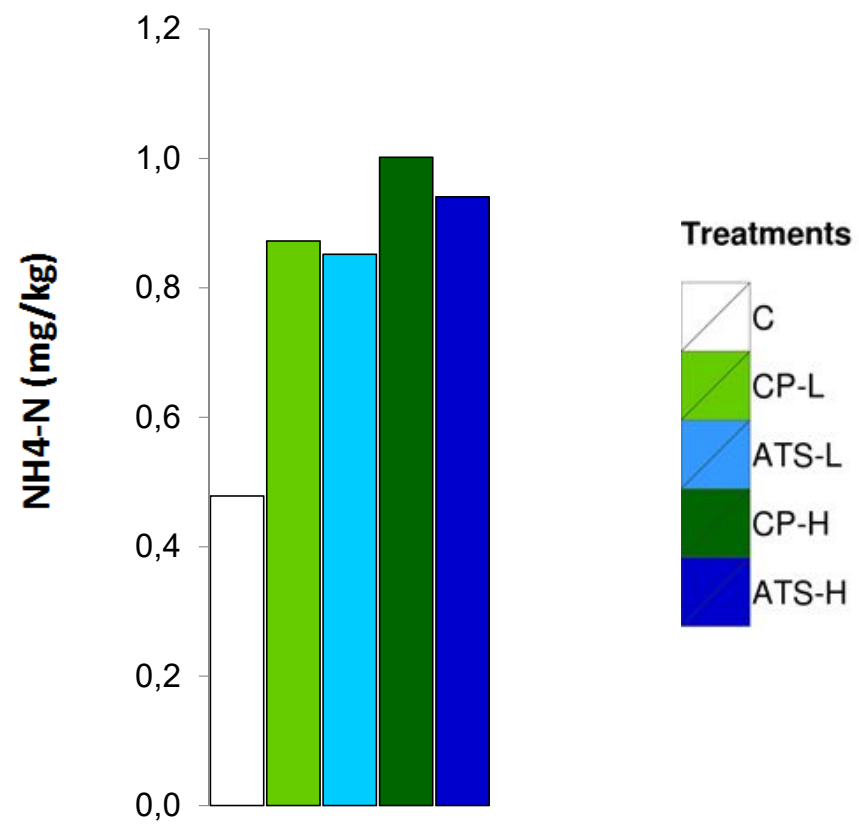


Soil organic carbon content



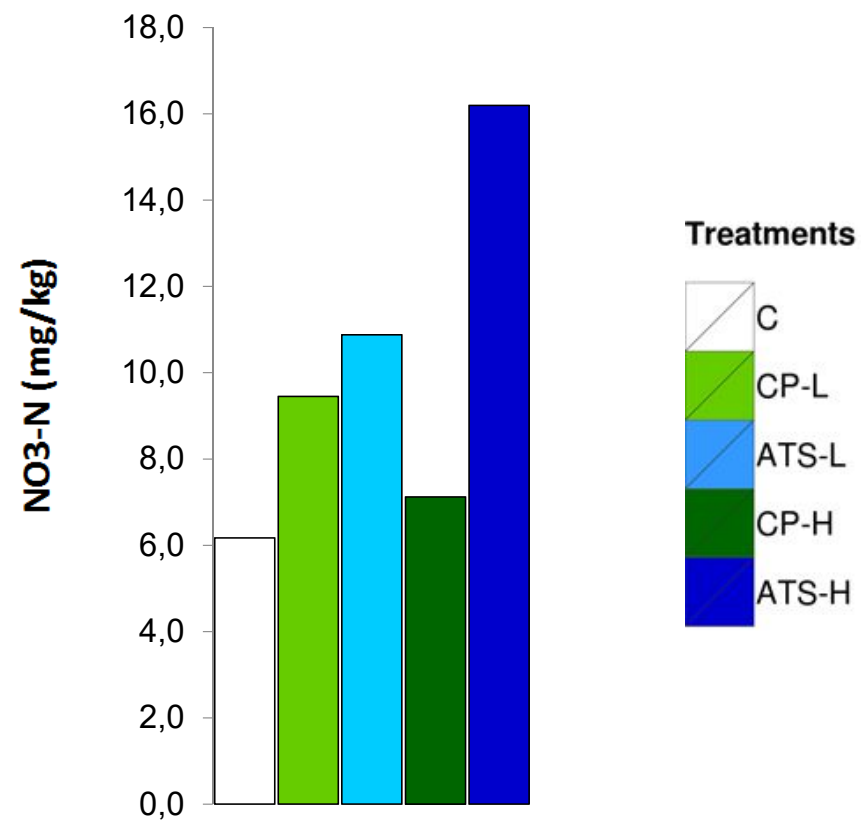


Soil NH₄-N content (mg/kg)



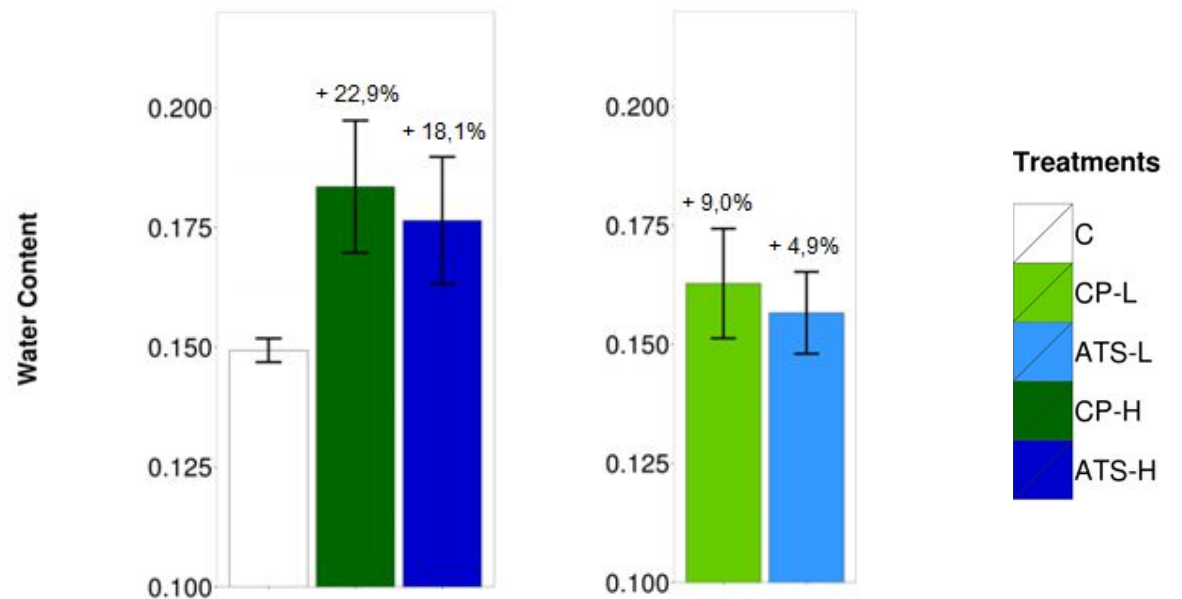


Soil NO₃-N content (mg/kg)



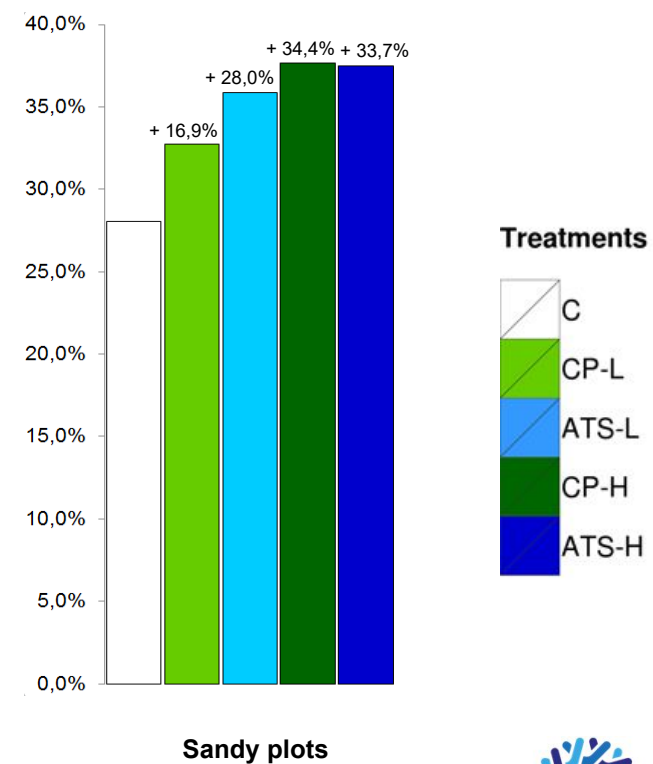
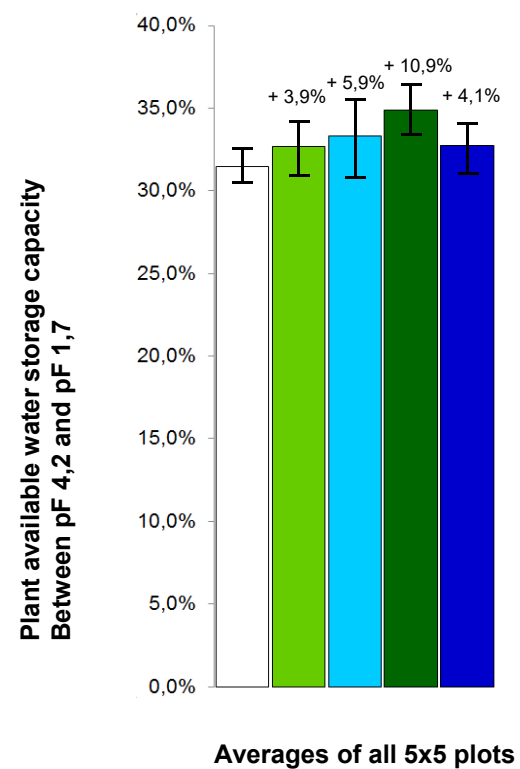


Soil water content





Soil water storage

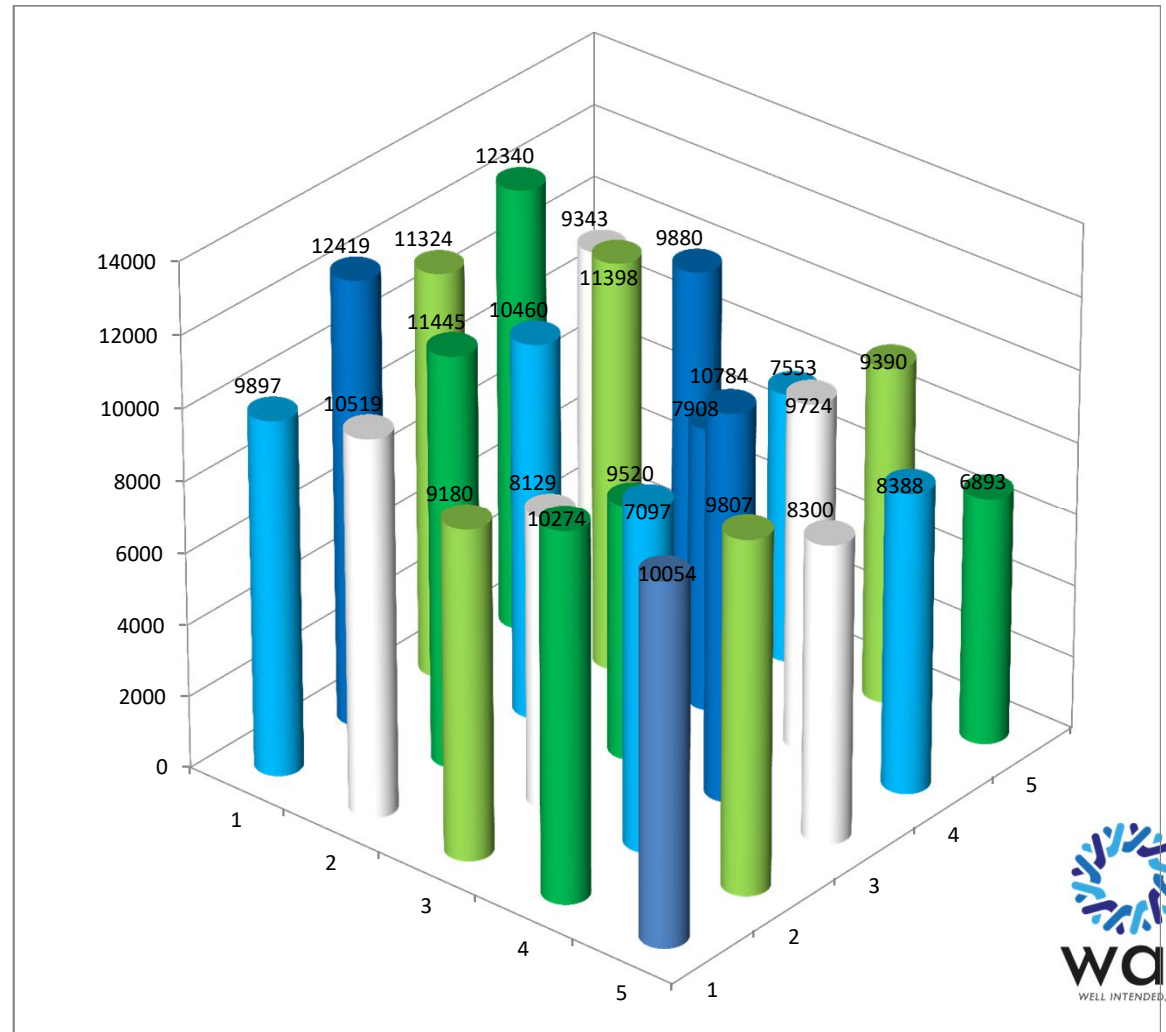


Harvest 2020



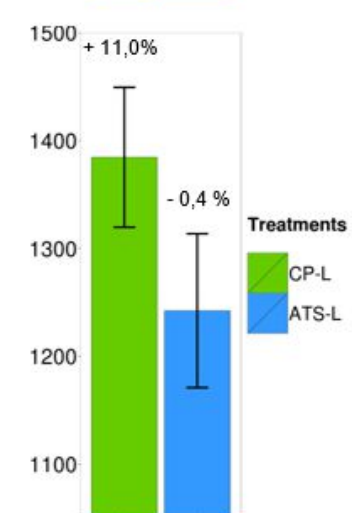
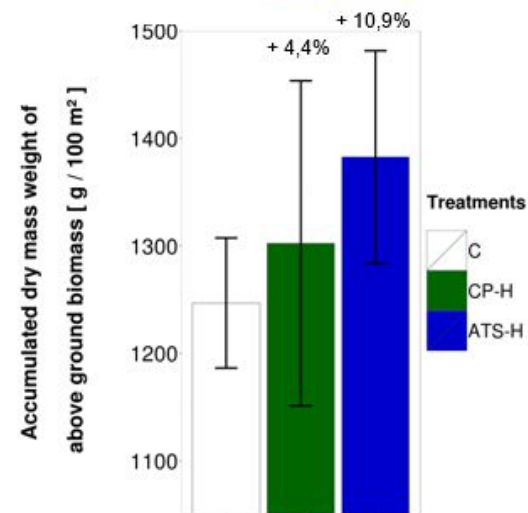
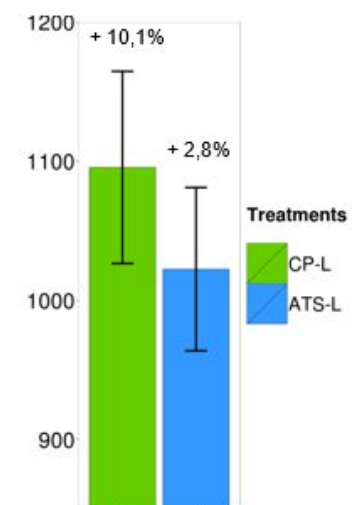
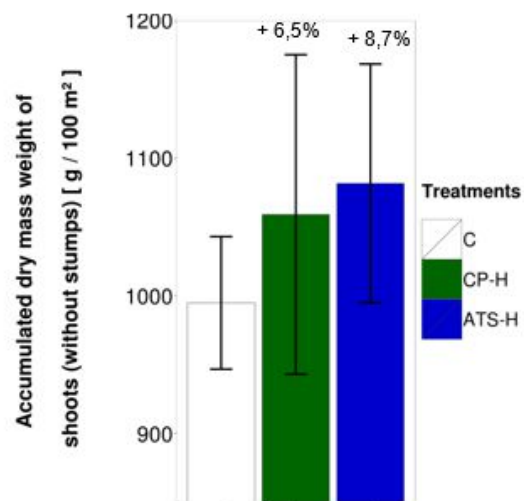


Yield distribution (above-ground biomass, gram per plot)



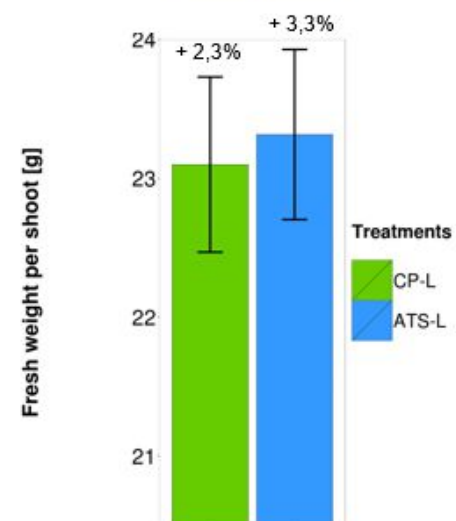
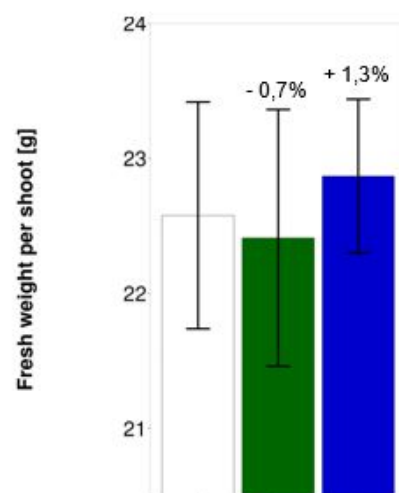
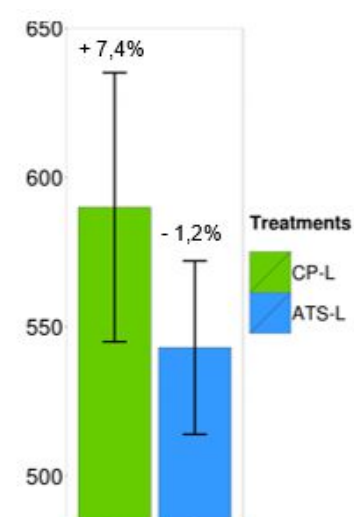
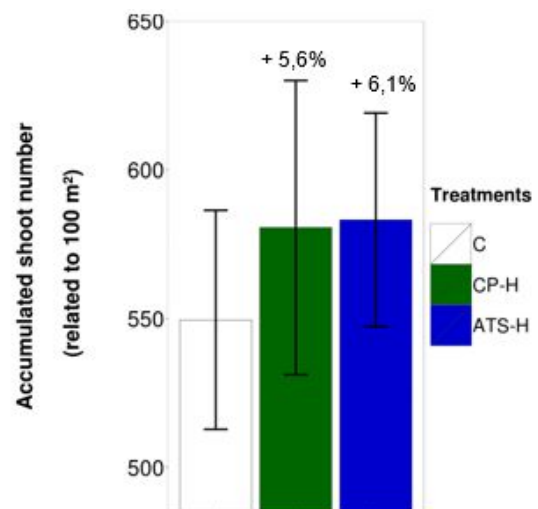


Yield (average of all 25 plots)





Yield (average of all 25 plots):





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 climate impact of biochar application at field trial	- 6,7 kg CO _{2eqv.} / kg asparagus	

Economical Assessment

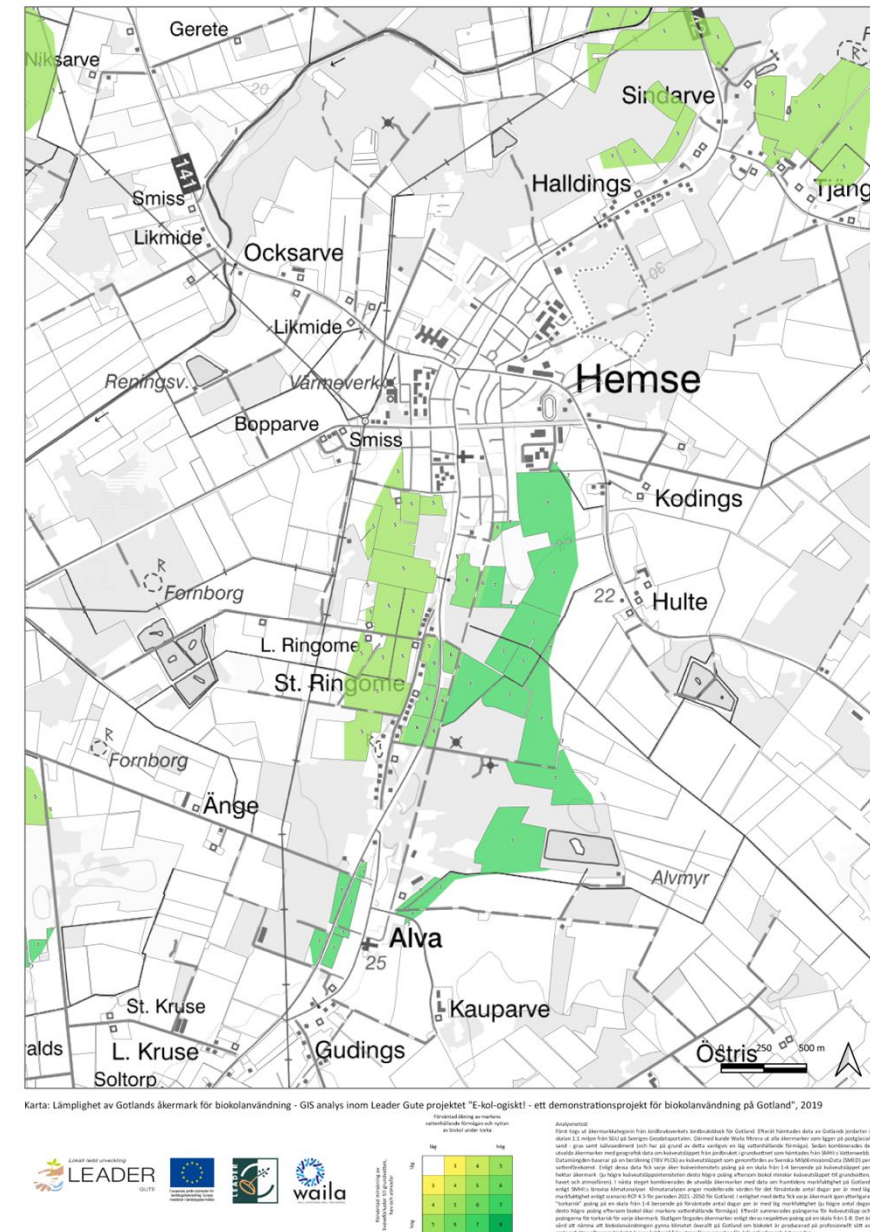


Economical Assessment (for 3 ton biochar fertilizer per ha, 15 years)

Benefit / Cost	SEK	Unit	Assumptions
Benefits			
Revenue Increase	11.409	SEK /ha*year	Yield increase: 7,5% (Baseline: 1300 kg/ha)
Nitrogen Fertilizer Savings	173	SEK /ha*year	25% nitrogen saving
Value Increase Farm Land	169	SEK /ha*year	Increase soil C-org: 0,2%
Carbon Storage	292	SEK /ha*year	3t CO ₂ sequestered, 500 SEK/t CO ₂
Costs			
Biochar Substrate	36.000	SEK/ha	3 t FM biochar/ha, 12.000 SEK/ton
Biochar Application	2.462	SEK /ha	
Harvesting and Marketing	5.914	SEK /ha*year	Cost for yield surplus
Surplus	77.090	SEK	Over 15 years
Return-on-Investment	7,6	%	

The Biochar Map for Gotland

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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
- Yield increase for all 4 biochar treatments (7% in average)
- We recommend to prevent manure putrefaction via early biochar addition or aeration
- Effective microorganisms might provide additional benefits
- Climate-positive crop production possible



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

Thank you for your attention!

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