Effect of anthropogenic soil management for increasing soil organic carbon status in Lithuanian acid soil

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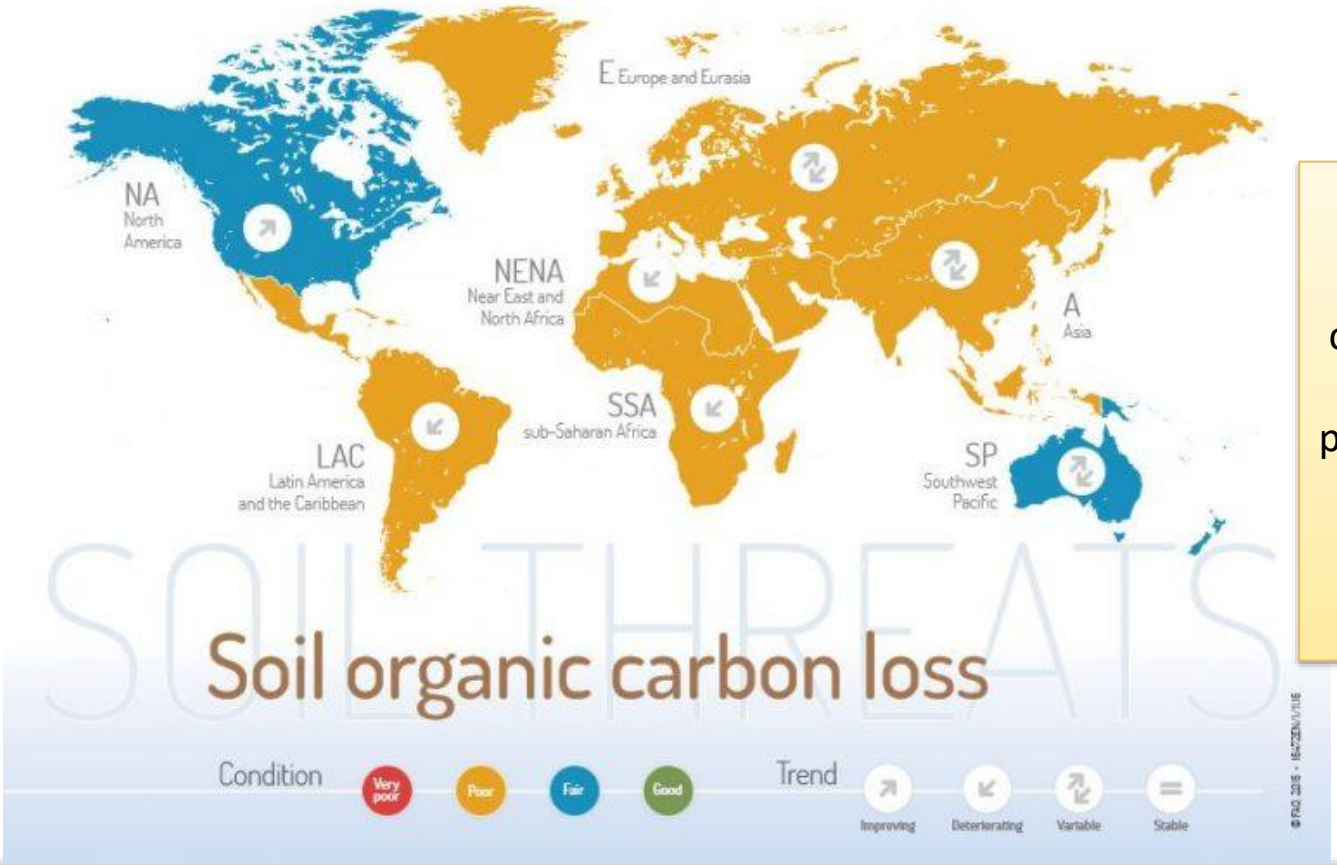
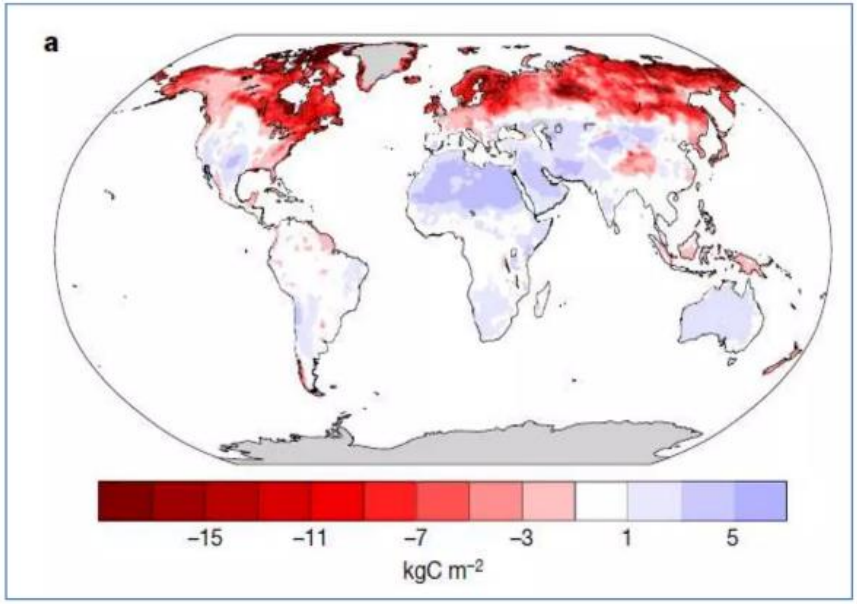
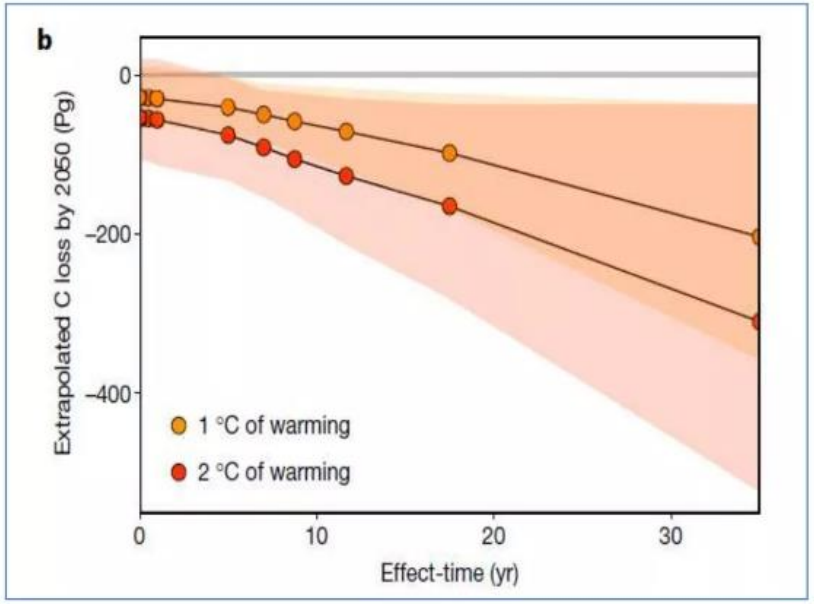
Lithuanian Research Centre for Agriculture and Forestry


our Soils under threat
2015 International Year of Soils
fao.org/soils-2015
#IYS2015
Deforestation
Population growth
Urban expansion
Pollution and waste disposal
Climate change
Unsustainable soil management practices
Drivers of soil degradation
Biodiversity loss
Salinization and sodification
Nutrient imbalance
Compaction
Sealing
Pollution
Acidification
Erosion
Loss of organic carbon
Types of soil degradation
Water scarcity
Food and nutrition insecurity
Rapid climate change
Poverty and social insecurity
Migration
Reduction of ecosystem services
Consequences of soil degradation
Solution: sustainable soil management
Inclusive soil governance
Increase investment in sustainable soil management
Advocacy/ awareness raising
Establish soil information systems
Develop capacities and strengthen extension on soils
Stop soil degradation
Restore/ rehabilitate degraded soils
Implement land use planning
Analyse/ assess soil condition
Increase soil organic matter content
Keep soil surface covered
Use nutrients wisely
Minimum tillage
Crop rotation
Reduce erosion
Appropriate waste disposal
Waste water treatment
Food and Agriculture Organization of the United Nations
with the support of



Decline of C stock affects soil fertility and climate change regulation capacity. The global loss of the SOC pool since 1850 is estimated at about 66 billion tones, mainly caused by land use change.





A) Projected changes in C stocks until 2050.

B) A global loss of C is projected for a 1° to 2°C rise in soil surface temperatures by 2050. (Crowther et al., 2017)

sustainable soil management

This study aimed to achieve following objectives: 1) analyse the alterations in SOC caused by the various management techniques in Lithuania's acid soil; (2) estimate and compare the effect size of different agro-techniques on SOC sequestration and other chemical parameters in acid soil; (3) determine an appropriate management practice benefiting for SOC sequestration and improving soil quality.

Methodology

- Comparison of data from three long-term studies, carried out in the western region of Lithuania, on physicochemical indicators served as the basis for the study. Over the past 24 years (1999-2023), changes in the properties of the soil have been identified.
- The soil of the experimental site is *Bathygleyic Dystric Glossic Retisol* (texture – moraine loam (clay 13–15%)).

Methodology –selected measures

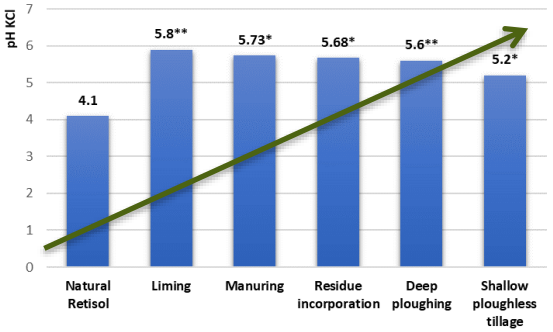
Soil liming

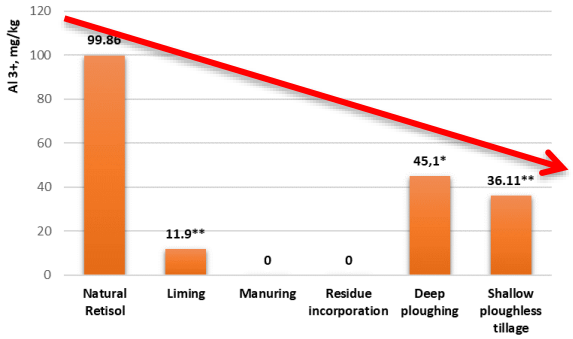
Soil manuring

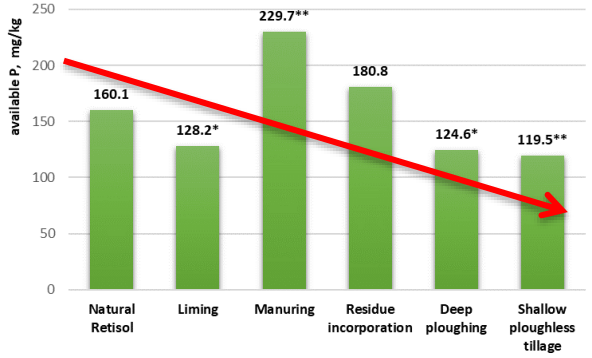
Residue maitenance

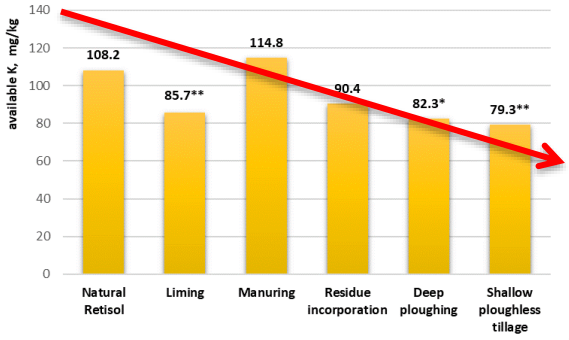
Soil tillage

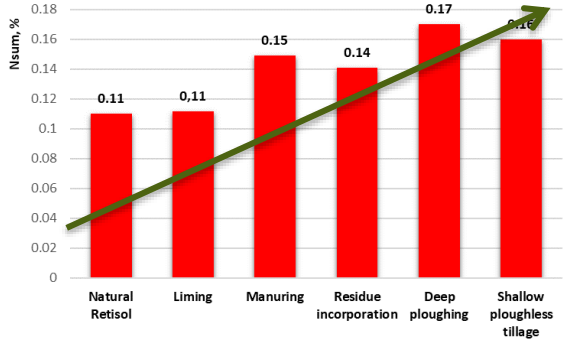
Comparison of main soil properties under different land management



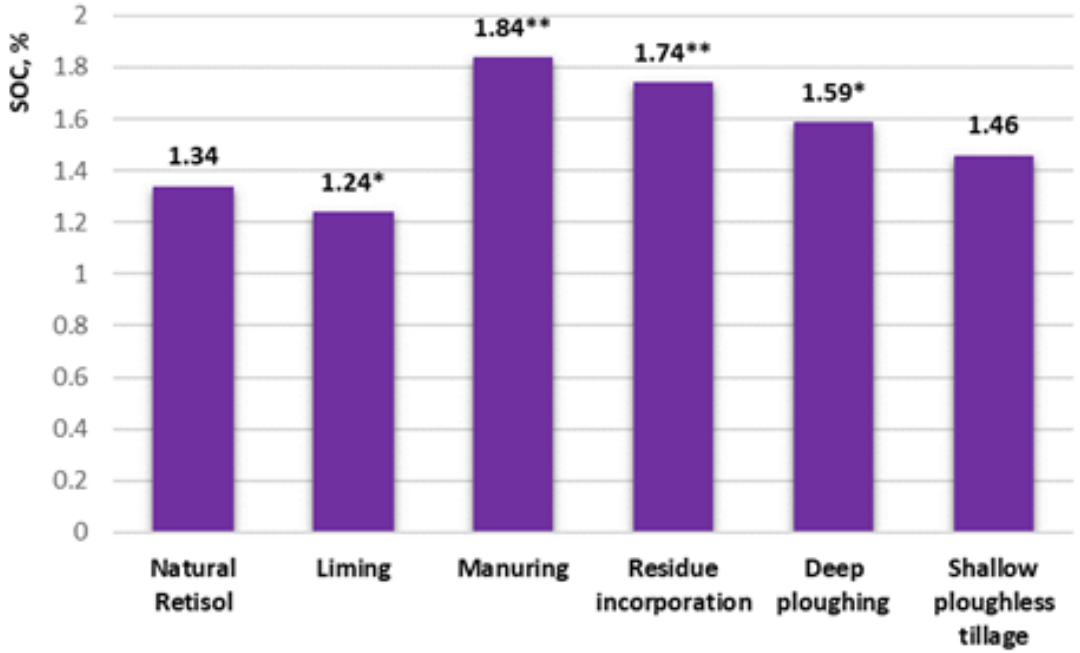




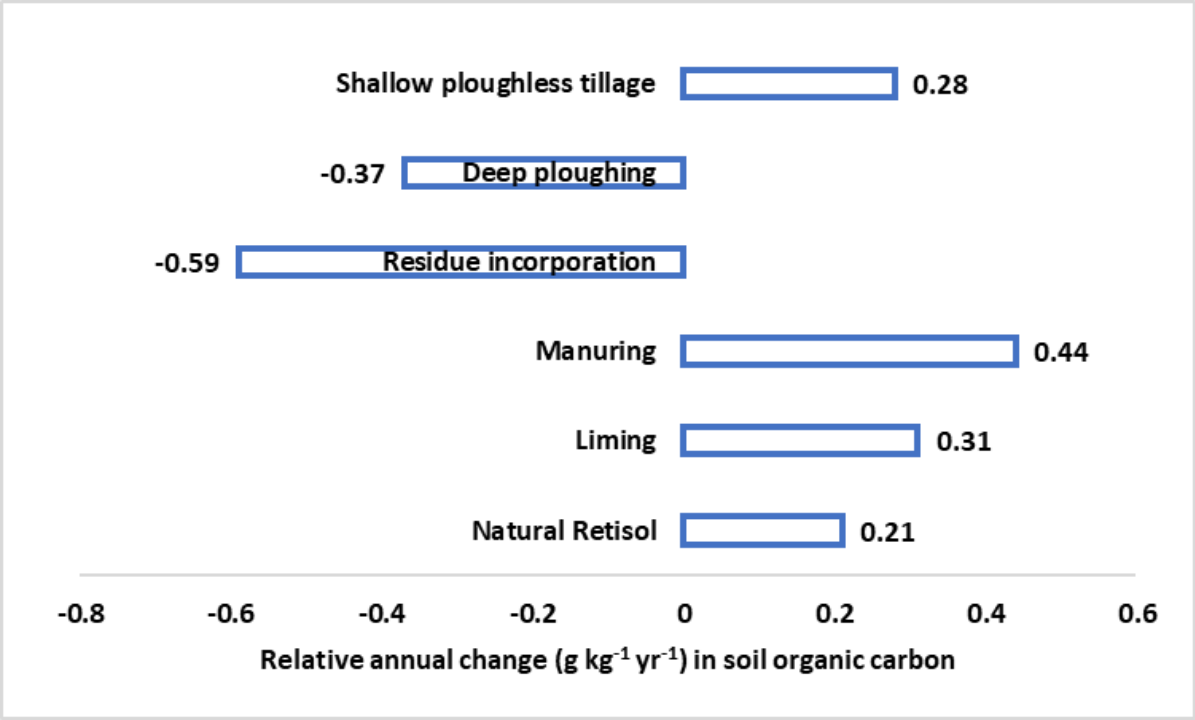


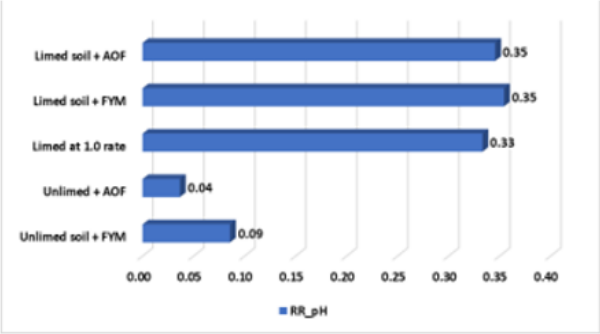


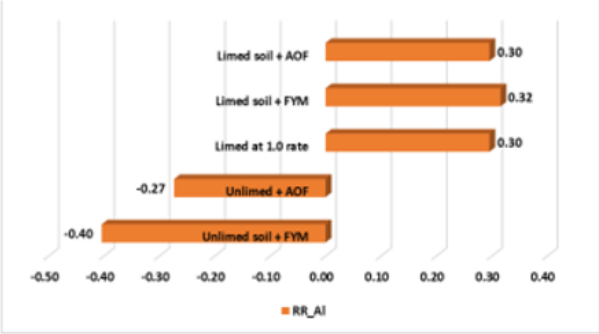
Changes in SOC content under different land management

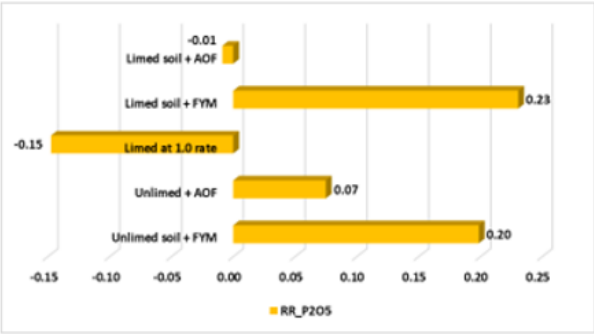


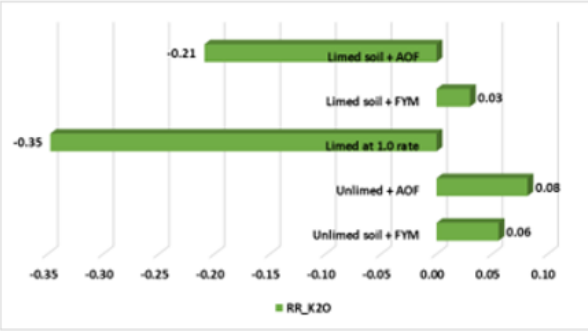
Evaluation of carbon transformation processes as influenced by different land management

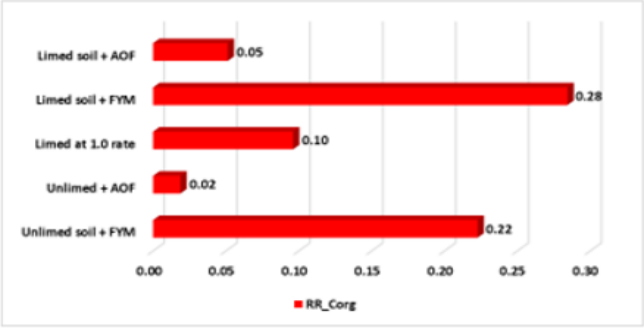












Response of acid soil properties to different fertilization types, where Al – mobile aluminum, P_2O_5 – plant available phosphorus; K_2O – plant available potassium; FYM – farmyard manure; AOF – alternative organic fertilizers. RR > 0 represents a positive effect, and RR < 0 represents a negative effect of applied agro-technique.

Effect of different fertilization on percent change of the mean effect size (RR) in acid soil

Treatments	Unlimed soil + FYM	Unlimed + AOF	Limed at 1.0 rate	Limed soil + FYM	Limed soil + AOF
pH_{KCl}	8.96	3.73	39.55	42.59	41.29
Al^{3+}	-33.24	-23.92	-44.42	-47.13	-44.42
P_2O_4	21.98	7.79	-13.71	25.93	-0.88
K_2O	5.75	8.53	-29.35	3.05	-18.85
N_{total}	17.05	9.30	6.20	15.50	9.30
C_{org}	24.94	1.89	10.09	32.89	5.26

SUMMARIZING:

- The analysis of soil organic carbon sequestration indices of studied agricultural practices ranked as: **manuring > residue management > reduced tillage > liming (in the direction of carbon transformation and sequestration)**
- The combination of liming and organic fertilizers was a relatively effective measure to improve soil quality.
- In general, conducted analysis provide an in-depth quantitative assessment of the effects of management practices on SOC content and other parameters, which could assist in further understanding the feedback of SOC to agricultural management practices and offer evidence in support of the preservation of the acid soil.

Thank you for your attention...