1.1. Soil quality assessment

Summary: Soil quality consists of physical, biological and chemical features. Soil structure, type and texture influence a lot in nutrient circulation, leaching and run-offs from the catchment basin. For example compaction caused by heavy machines and grazing reduce water infiltration capacity, root growth and nutrient uptake by plants and thus cause more surface run-offs into water bodies. In addition, soil degradation leads to inefficient use of fertilizers and causes loss of resources.

Operation and Maintenance: Regular assessment is the basis for soil protection planning and thus sustainable management.

Efficiency: Yield benefits from improved soil quality are significant, long-term increase in crop production revenue even up to 50 % is possible. Avoidance of soil compaction can increase cross margins over 110 €/ha. Alone subsoiling method can increase cross margins around 10 – 20 €/ha.

Efficiency and functionality Costs of the Practice Ease of Operation Potential for nutrient recovery

Basics of the good practice:

- Regular systematic observations and evaluation of fields: signs of compaction, erosion or surface bonding, excavation test (roots, earthworms, crumbling, water conductivity).
- Regular soil testing: organic matter contents, pH, soil compaction (penetrometer), etc.
- Soil mapping and classifying: publically available laser scanning materials, slope and contour maps, samples for fertility assessments from different field zones.
- In Finland soil quality assessment for over 0,5 ha field areas is obligatory for those farmers who are engaged to environmental compensation subsidy.

Farm practices towards a good soil quality:

- Adding organic matter like animal manure, residue from the previous crop or cover crops.
- Diminishing soil compaction by decreasing axel loads and avoiding excessive tillage.
- Sustainable and efficient nutrient/fertilizer management.
- Keeping the ground covered, erosion control.
- Maintaining and enhancing biodiversity, crop choices and rotations.
- Monitoring soil performance regularly and systematically.

Cost of the good practice (Finland): Basic soil test (soil type, pH, conductivity, Ca, K, P, Mg, S, cation exchange) 15 €/sample, fertility assessment (microbiological activity, C/N-ratio, organic content) 60 €/sample.

Ability for climate chance effects mitigation: Sustainable soil quality management plays an important role in compensating harmful effects foreseen to be caused by climate change, like rainy and dry seasons variations as well as increased flooding. Good soil structure will remarkably diminish surface runoffs and soil degradation caused by erosion.

Potential for nutrient recovery: Good soil structure improves nutrient uptake by plants, root growth and overall yields.

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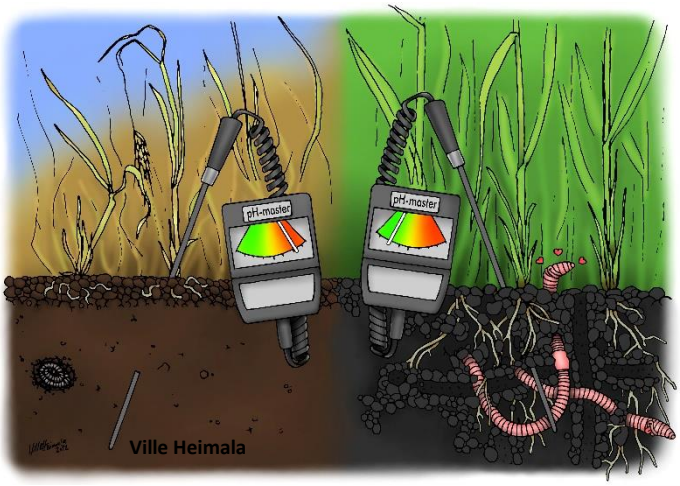
Evidence of Success: Assessment of soil physico-chemical condition



Appropriate performance indicators:

- Soil water holding capacity (% of dry weight)
- Rooting depth (mm)
- Bulk density / penetrometer (kg/m^3**)**
- Visual evaluation of soil texture and structure
- Stability of aggregates??????
- Macro-porosity
- Infiltration capacity (mm/hour)

Additional factors/ indicators:

- Soil contamination (heavy metals/ plastics)
- Nutrients (P, K, Mg), N/P ratio, pH
- Soil organic matter balance

Achieved environmental benefits:

- Availability of nutrients increases -> use of fertilizes can be reduced.
- Nutrient runoffs / upstream and downstream pollution are reduced.
- Application of minerals estimated optimal to ensure maximum yield response.
- Mitigation climate change effects caused by heavy rains or flooding.
- Good soil structure gives optimal circumstances for growing crops sustainable, controlling water flow, filtering water from impurities and storing carbon.

Table: Silage grass yield percentages at different soil pH ranges (EBLEX 2013).

pH	<4,5	4,5-5,0	5,0-5,5	5,5-6,0	6,0-6,5
% max yield	87 %	88 %	91 %	96 %	100 %

MORE INFORMATION:
https://www.proagria.fi/en/sectors/crop
http://www.virtuaali.info/efarmer/peltomaan_laatutesti/
https://www.sciencedirect.com/science/article/pii/S0167198714001901?via%3Dihub
https://www.terranimo.world/Landing.aspx

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