Testing the Effect of a Microbial-Based Soil Amendment on Aggregate Stability and Erodibility

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Introduction

- Soil erosion by water is a common soil degradation problem in the world.
- Minimizing soil erosion is essential for maintaining proper soil quality.
- The erodibility of the soil is closely linked to its structural stability as well as its infiltrability.
- Different amendment practices can be used to control soil degradation induced by water erosion

Objectives

- To test the effect of a microbial-based soil amendment on soil aggregate stability and erodibility.
- To test the effect of the microbial agent's carrier solution as well as a commercial gypsum amendment product.

Materials

- **Investigated agricultural soils**

  Denmark
  - Flakkebjerg
    - Sandy loam (11% clay)
    - 2% organic matter
  - Risø
    - Sandy loam (14% clay)
    - 2% organic matter

  Tanzania
  - Mwanza region
    - Sandy loam (6% clay)
    - 0.7% organic matter
- **Soil treatments**
  - Novozyme microbial-based soil improver (**MICRO**)
    - 22.5 L/m³ dry soil
  - Microbial agent carrier solution (**CAR**)
    - 22.5 L/m³ dry soil
  - Gypsum powder from Yara A/S (**GYPS**)
    - 1.5 g/kg dry soil (corresponding to 5 tons/ha)
  - Untreated control soil (**CON**)

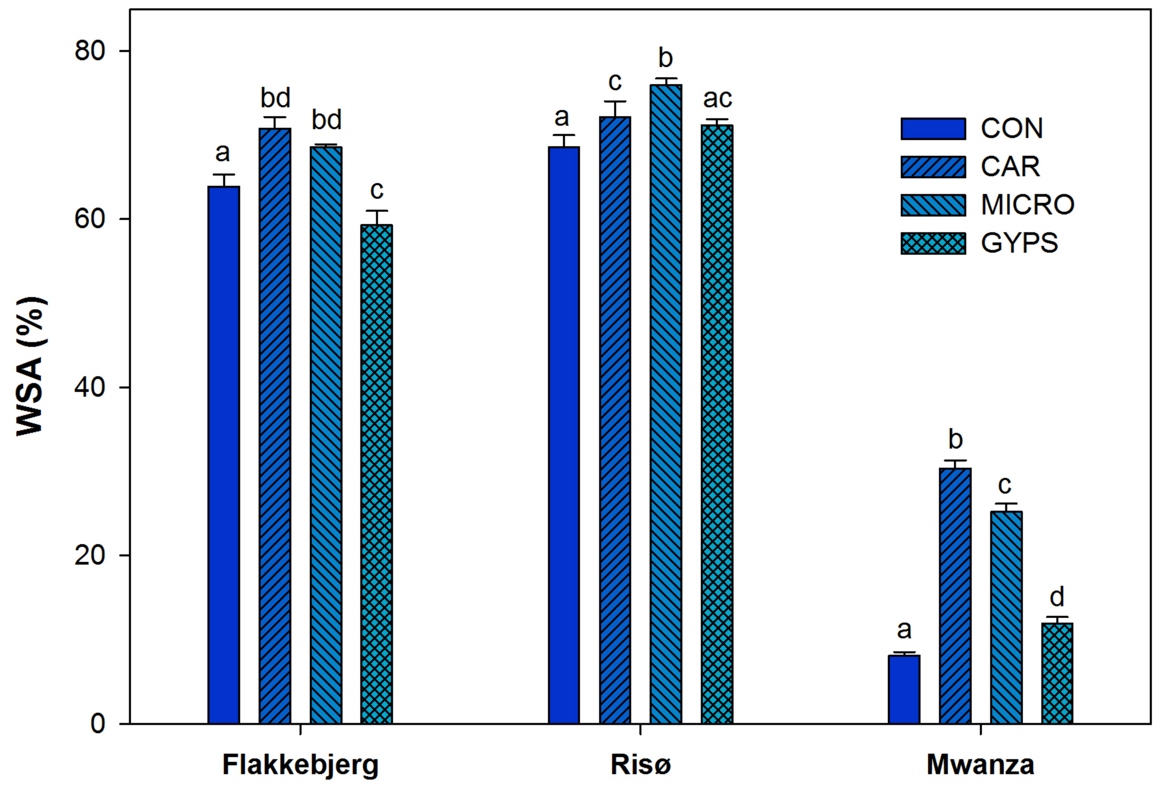
Methods

- **Water stable aggregates**
  - Yoder wet sieving apparatus (250-µm sieve)
  - Aggregates <8 mm
  - 2-min vertical sieving process
- **Clay dispersion**
  - End-over-end shaking (1, 2, 4, and 8 minutes at 33 rpm)
  - Aggregates <8 mm
  - Suspension dried to determine the weight of dispersed clay
- **Soil erodibility (rainfall runoff simulation; Hu et al. 2014)**
  - Square flumes with surface area of 0.04 m²
  - (10% inclination)
  - 4-hour simulation at 30 mm/h rainfall intensity

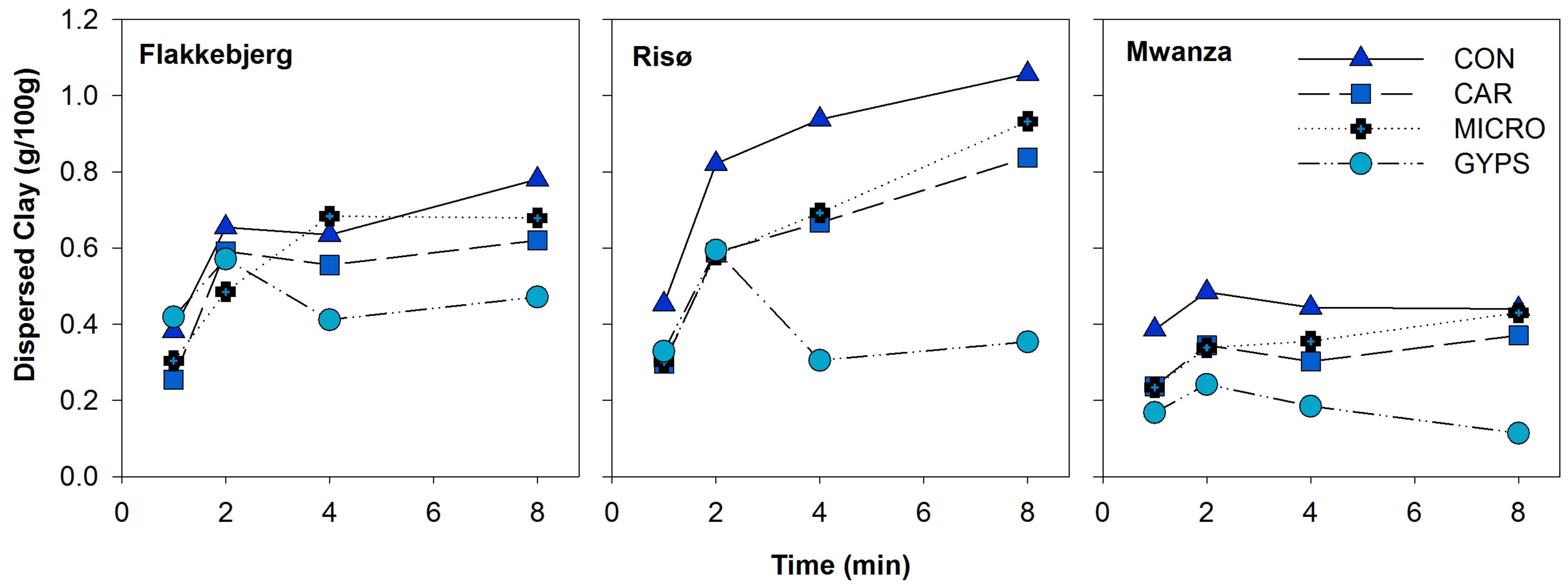
- Setup of rainfall runoff simulation

Results

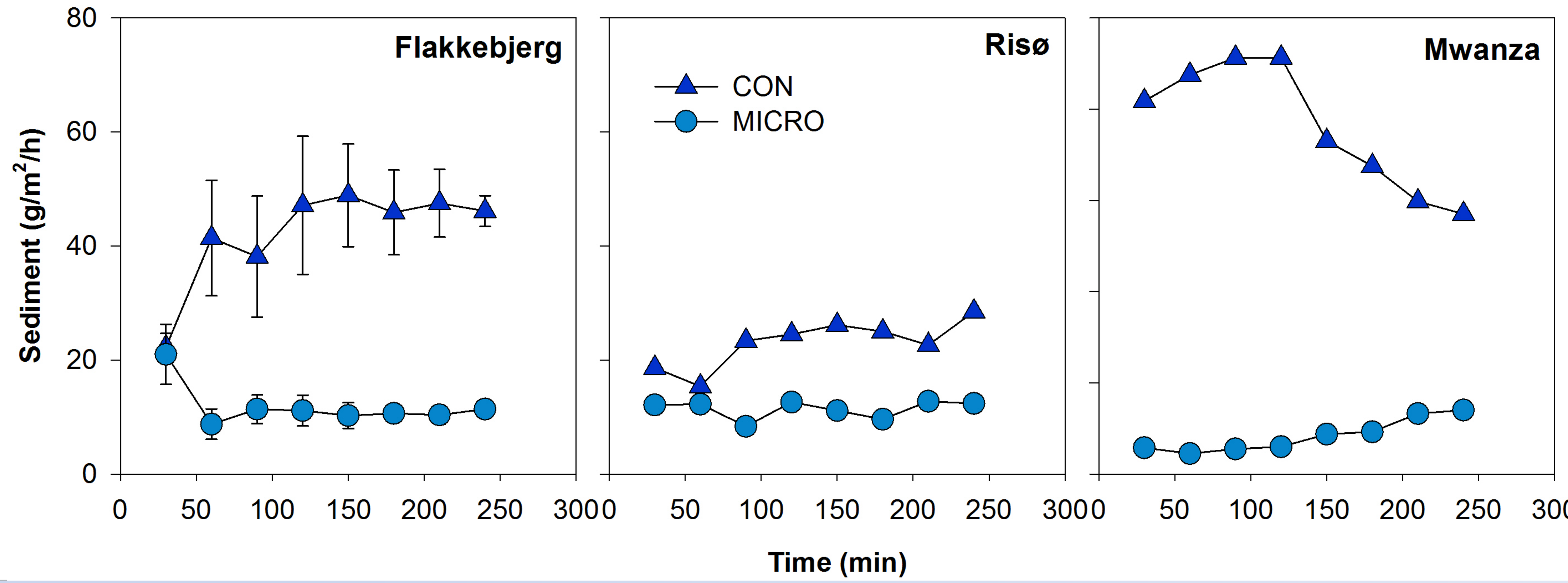
- **Water stable aggregates (WSA)**



- **Clay dispersion**



- **Soil erodibility**



- Physical visibilities of CON and MICRO treated soil samples after the end of the rainfall-runoff experiment

Acknowledgments

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References

Hu, Y., Kuhn, N. J. & Heckrath, G. J. 2014. Investigations on Temporal and Spatial Variation of Slope-Scale SOC Erosion and Deposition. PhD, University of Basel.

Conclusions

- In general the microbial-based product (MICRO), its carrier (CAR), as well as the gypsum (GYPS) product increased aggregate stability compared to the control soil (CON).
- Most pronounced effects were seen in relation to the rainfall-runoff experiment where the microbial-based product (MICRO) had a clear effect on soil erodibility.
- In relation to measurement of aggregate stability (WSA) as well as clay dispersion, the picture was less clear.
- Especially for the more sandy Tanzania soil (Mwanza) with a low content of organic matter, a clear effect was seen on the aggregate stability. However, the effect was minor for both the microbial-based product (MICRO) and the carrier treatments (CAR).

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