Impact of tree rows on litter decomposition in temperate agroforestry systems

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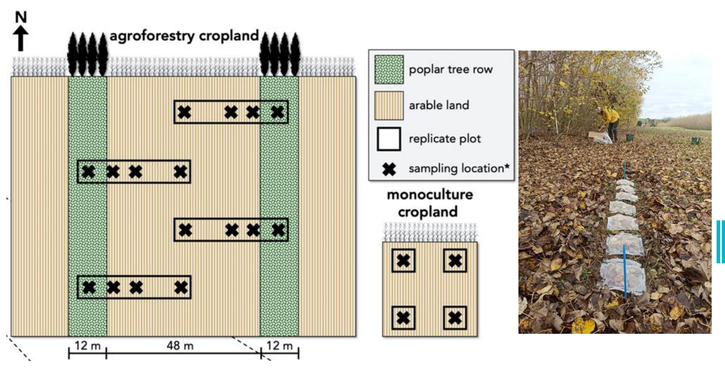
Introduction

Litter decomposition is a vital soil function performed by soil decomposers, with the contribution of soil fauna.
The release of carbon and nutrients during decomposition is essential for soil fertility and plant growth. As a result, the production of tree litter and its decomposition are crucial for nutrient cycling in temperate agroforestry systems, which are considered sustainable alternatives to conventional agriculture (Veldkamp et al. 2023). Our objective was to investigate the effect of agroforestry and distance from tree rows on litter decomposition in temperate agroforestry systems in comparison to conventional croplands.

Methods

Litterbag preparation: collection, bag making, weighing litter in.



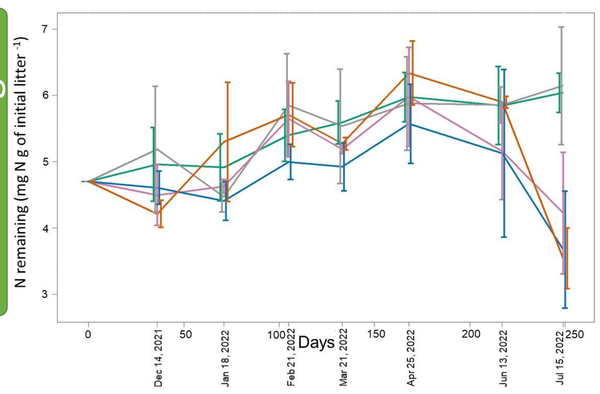
Setup: seven sampling dates. Five different locations: tree row, 1m, 7m, 24m distance from the trees and open cropland as a reference land use.

Analysis for each collection date
Litter: mass recovery, moisture, nutrient release.
Soil: soil bulk density, water filled pore space, moisture.

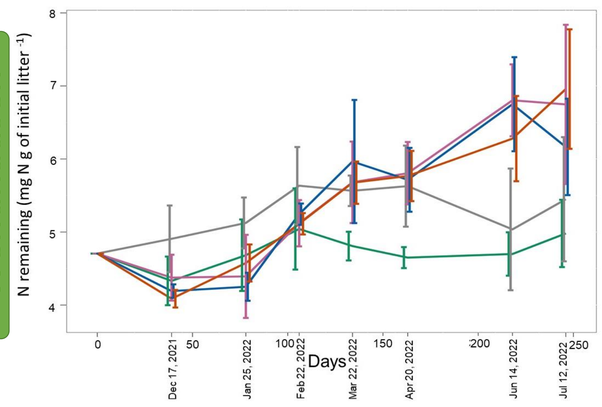
Results

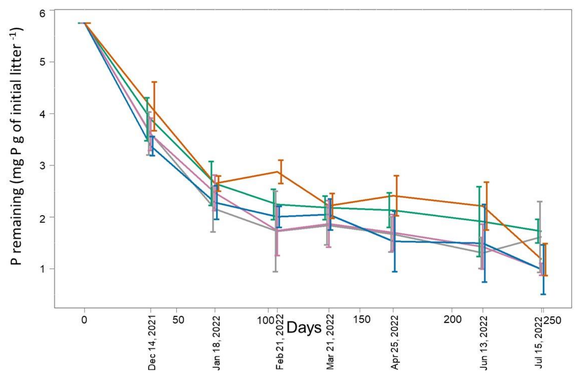
Linear mixed-effect models with repeated measures revealed differences between locations for C and N recovery at both sites. Litter moisture was the most important driver of mineralization of C and nutrients during periods I,II, and III based on correlation analysis. Soil moisture and WFPS became more important from the IV to VII period . In Dornburg, decomposition rate was lower in tree rows and 1m distance compared to the other locations (P<0.05).

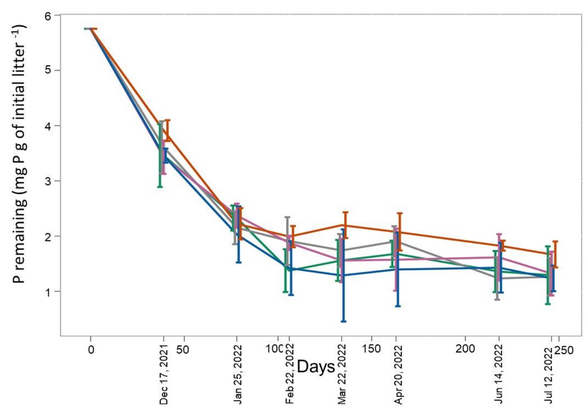
Dornburg



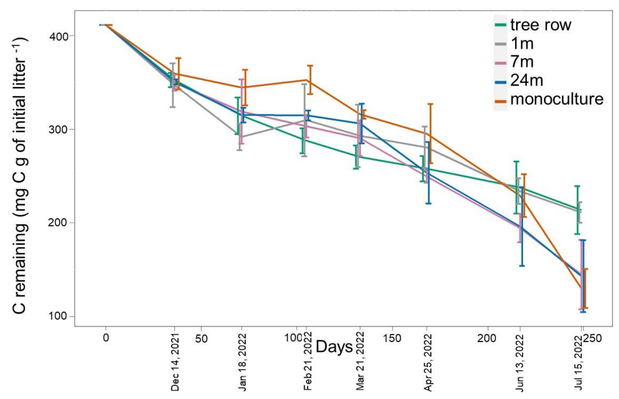
Wendhausen







Dornburg



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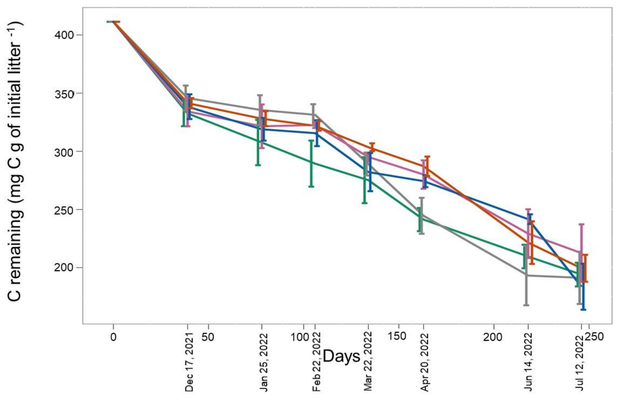

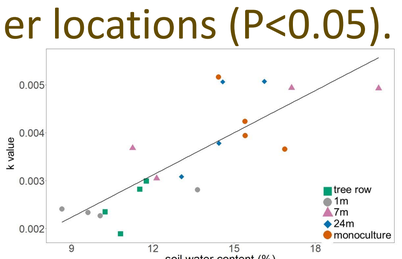

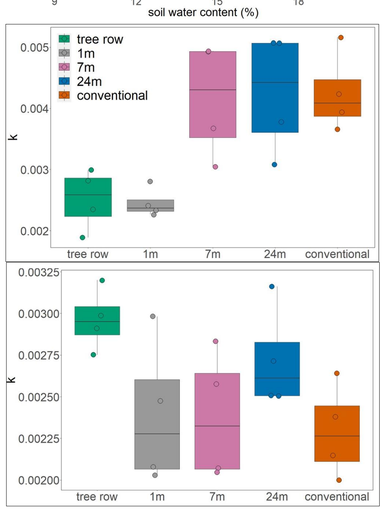

Conclusion

Water availability is a crucial factor for litter decomposition in agroforestry systems. However, our results also reflect the site specificity as well as seasonal differences in the predictability of this process. Together with micro- and mesofauna data to be determined and previous findings on microbial communities across our sampling locations, we expect to draw biological inferences on the major drivers of decomposition and nutrient release dynamics in agroforestry systems.

Acknowledgements

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References: Veldkamp E, Schmidt M, Markwitz C, Beule L, et al. 2023. Multifunctionality of temperate alley-cropping agroforestry outperforms open cropland and grassland. Communications Earth & Environment 4(1):20.