Alena Förster

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PhD Candidate Alena Förster is one of the authors of the paper "Nematode community structure suggests perennial grain cropping cultivation as a nature-based solution for resilient agriculture". This study was conducted at SITES Lönnstorp Research Station during 2021-2022. In this interview, the author shares insights with the SITES Community about the project and experience conducting research at a SITES Lönnstorp.

Why is it important to cultivate Kernza® wheatgrass for sustainable agriculture?

The current high-intensity annual agriculture degrades the soil ecosystem, including nutrients and biodiversity, through destructive soil management techniques such as tillage and the excessive usage of synthetic chemicals (e.g. fertilizer, pesticides). Kernza®, developed by The Land Institute in Kansas, is a perennial grain, also known as Intermediate Wheatgrass (*Thinopyrum intermedium*), and develops an extensive root system as the crop regrows from the roots after each vegetation period as tillage is eliminated. The increase of nutrient retention and water use efficiency or the reduction of erosion potential are just a few benefits of the perennial crop. Additionally, the all-year surface cover provides a disturbance free habitat for soil biota.

What are the main findings of your project?

My dissertation project compared the effects of Kernza® and annual wheat cultivation on the soil ecosystem (earthworms, nematodes) across three countries (France, Belgium, Sweden) over two years. This allowed for an extensive investigation across different climatic and soil conditions to exclude that any discovered benefits of Kernza® over annual wheat would be connected to these basic conditions and not the crop culture itself. Kernza® showed improved earthworm diversity compared to annual wheat, indicating its great potential as soil fauna habitat. Additionally, nematode analysis characterized Kernza® as an undisturbed system with a heterogeneous resource environment and potential greater nutrient cycling. This allows the crop to also grow on degraded lands, where conventional agriculture would otherwise not succeed.

How can the results be applied in society and be utilized by different stakeholders?

A complete switch from annual to perennial crops is neither feasible nor desirable. The aim is rather to integrate perennial into annual agriculture. The latter would then protect the neighboring watercourses from nutrient run-off through their extensive root system and improve biodiversity in the soil through

buffer strips or similar. In addition, the cultivation of perennial crops can expand the areas available for food production, as they can be grown on marginal land that would otherwise be unsuitable for annual cultivation due to poor soil quality.

Has a collaboration with other researchers, research groups, stakeholders and companies taken place?

My dissertation project was part of a larger project called NAPERDIV ('Nature-based perennial grain cropping as a model to safeguard functional biodiversity towards future-proof agriculture'; 2019-2020 BiodivERsA joint call) and consisted of a large consortium of researchers from Europe. This allowed for an extensive investigation of the effects of Kernza® on the soil ecosystem, including factors like microbes and the crop itself. The team consisted for example of researchers from ISARA (Institut supérieur d'agriculture Rhônes-Alpes) in Lyon and the University of Liège (Gembloux Agro-Bio Tech). A compilation of all collaborators can be seen on our website.

From left to right: earthworm sampling in the field; Lumbricus castaneus, an epigeic earthworm species that inhabits the litter layer and is therefore only found in Kernza® and not in annual wheat fields; a split tube sampler allows for the vertical investigation of the soil ecosystem; a bacterivorous nematode under the microscope (photo: Alena Förster)

What has been done at SITES Lönnstorp Station?

The sampling campaigns were conducted in spring and autumn of 2021 and 2022. Earthworm sampling consisted of a combination of hand sorting the topsoil and extraction with AITC (allyl isothiocyanate) to obtain the deep-burrowing species as well. The sampling of both nematodes and soil with a split tube sampler allowed for the investigation at two depths to account for the effects of the extensive root system under Kernza®.

What is the added value in performing data collection at SITES stations?

For our investigation it was essential to take samples from already established Kernza® cultures. As the team from SITES has years of experience regarding this crop culture, we could benefit from their knowledge. In addition, the rotation system of the station's field areas, which are divided into four blocks, contributed to a realistic imitation of agricultural fields.