Chances and hurdles for the establishment and performance of different agroforestry systems in Lower Saxony – ELAN

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Current situation

Agroforestry systems are agricultural management systems in which trees or shrubs are grown simultaneously with, or between, cropland or pasture. There are many successful agroforestry systems worldwide and studies have shown that agroforestry can be profitable in Germany while providing additional benefits such as carbon sequestration, erosion control, increased biodiversity and improved soil quality. In 2021, the Federal Council included agroforestry in the direct payment system of the EU's Common Agricultural Policy. This removed an important obstacle for farmers to implement agroforestry systems in Germany, although there is currently debate as to whether the eco-regulatory subsidy of €60/ha of wooded area included in it is sufficient. Despite the advantages of agroforestry and the efforts of political actors to remove legal barriers to the establishment of agroforestry, the introduction of agroforestry in Lower Saxony has been slow and mostly concentrated on a few agricultural niches such as agrosilvopastoral systems or agroforestry in chicken runs. Reasons often cited by farmers for not implementing agroforestry systems include: high investment costs, irregular payment flows, unclear funding opportunities and restrictions, and lack of knowledge about agroforestry systems and their multifunctionality.

The problem

Current agricultural practices on many farms in Germany focus on high agricultural productivity and profits, while external costs from soil degradation, water pollution, increased greenhouse gas (GHG) emissions, loss of biodiversity are borne by society as a whole. There is no doubt that intensively managed arable land pure crops perform exceptionally well in agricultural production. However, their adverse environmental consequences have raised awareness that modern agricultural systems should focus not only on high production, but also on providing important ecosystem functions and landscape features that promote biodiversity conservation, carbon sequestration and reduced pollution and land degradation. A comprehensive study of alley-cropping agroforestry systems in Germany (consisting of rows of fast-growing trees, so-called short-rotation plantations in

combination with cropland or open grassland) conducted at the University of Göttingen showed that conversion to alley-cropping agroforestry significantly increased carbon sequestration, habitat for biological activity and resistance to wind erosion without compromising yield and profitability. However, nutrient cycling, non-CO2 GHG emissions and water regulation did not improve due to inappropriate management practices such as high fertilisation rates that exceeded crop needs.

Goals

The proposed project has three main objectives:

1) To identify economic, social and agronomic hurdles, to analyse economic risks on the basis of concrete business data and to point out potential solutions that can contribute to an increased establishment of agroforestry systems in Lower Saxony.

2) Analysis of the contribution of agroforestry systems to plant health and food safety, such as the analysis of effects of woody strips on phytopathogenic pests (e.g. *Fusarium* species in small grain cereals and maize, *Verticillium longisporum* and *Leptosphaeria species* in oilseed rape and *Phytophthora infestans* and potato virus Y in potatoes) and toxic secondary metabolites (mycotoxins).

3) Identification of ecosystem services in young agroforestry systems. Previous research in our group has shown that implementing alley cropping systems improves carbon sequestration, habitat for biological activity and resistance to wind erosion without compromising yield and profitability. However, ecosystem functions that were associated with fertiliser applications (e.g. nitrate leaching, non-CO2 GHG emissions) did not improve. Within the proposed project, initial sampling on nutrient supply and carbon accumulation will be carried out. In the proposed project, we want to assess how (young) agroforestry systems and their reference systems perform with respect to global warming potential and whether this can be improved by a more optimal nutrient management.