Vegetation Diversity and Weed-pressure in Alley-cropping Agroforestry in Switzerland

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Introduction

Alley-cropping, the integration of tree-lines in arable fields, is a practice with positive ecological, economic, and social effects (Torralba et al., 2016; Thiesmeier & Zander, 2023). However, the understory vegetation (spontaneous or not) in the tree-lines may act as a reservoir for weeds and increase the pressure (spillover) on the arable crops. Therefore, many farmers sow species-poor seed mixtures, containing mainly grasses, to avoid the potential spillover-effects. This results in simple floral communities in the tree lines with limited benefits for biodiversity (plant richness, feeding and nesting resources for insects).

However, the relationships between tree-lines species-richness and weed pressure in arable fields are still unclear. Boinot et al. (2019) showed that the spillover effect is generally weak and limited to the area near the tree lines. But do agroforestry systems with higher species richness also suffer from increased weed pressure? And are problematic weeds more present in species-rich vegetation communities in the tree lines?

This study aims to examine whether increased weed-pressure is restricted to the arable areas close to the tree lines (1-2m) and whether there is a relationship between species richness and weed pressure and which.

Research questions

- Is there an increased weed-pressure in the arable field-zones near to the tree-lines, compared to more central zones of the fields?
- Do agroforestry systems with higher species richness in the tree-lines suffer from increased weed-pressure (spillover) in the arable crops?

Methods

The data collection has been conducted in 2022 and 2023 in 20 silvoarable agroforestry systems (organic and conventional) in Switzerland. Vegetation surveys (recording of all plant species and their relative coverage) of the tree-line vegetation were carried out. All species in six 1m x 1m plots and their relative coverage were recorded. In the arable-fields, surveys of the weed-cover in three different distances from the tree-line (0.5, 2 and 8 m) were carried out. All species in 0.25 m2 have been registered, together with their relative coverage and the crop-coverage.

Results

In total 210 plant species were found in the 20 agroforestry systems. 90 of them were also found at least once in the arable-fields. The maximum number of species found in one system was 70 and the mean number of species per square-meter 10. In the arable fields, the mean weed-cover was 5% for conventional and 14% for organic systems.

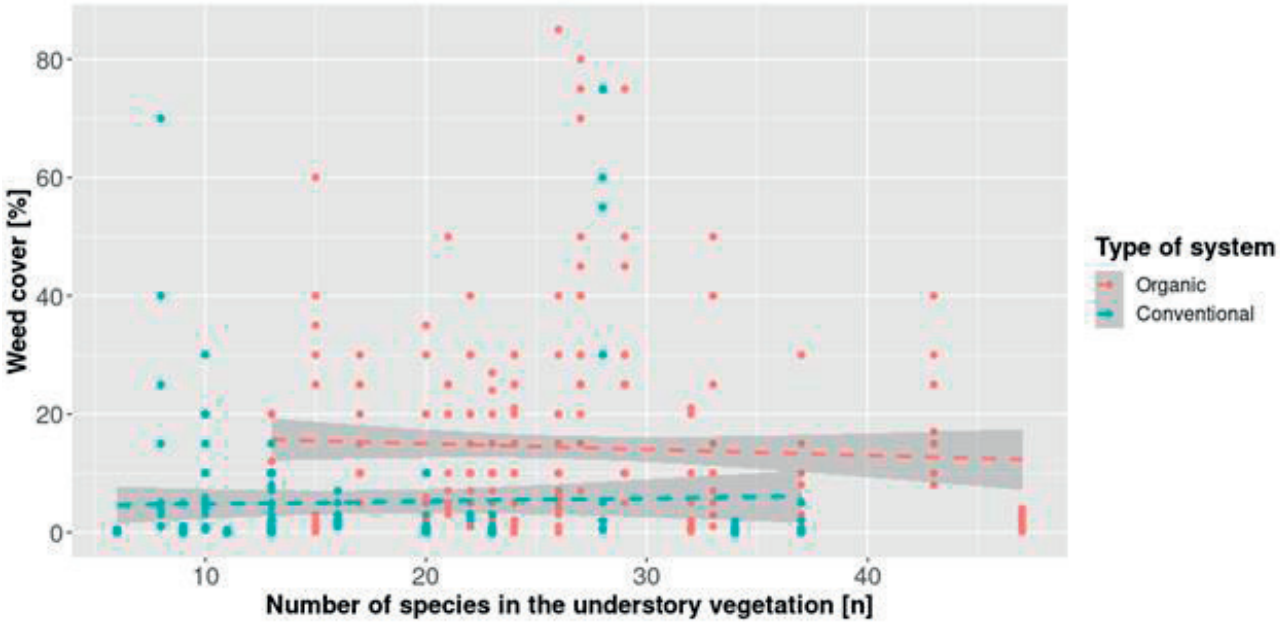
The results do not show any significant difference between weed pressure near the tree-lines (distance of 0.5m) in comparison to the central zones (distance of 8m) of the arable-fields. This indicates that the spillover-effect is marginal and does not increase the weed-pressure significantly. Also, the species-richness of the tree line vegetation did not have any effect on weed pressure, indicating that sowing species-poor mixtures does not have any beneficial effects. The main differences are explained by the farming-system, with organic farming suffering from more weed pressure than conventional farming. This effect is not related to agroforestry, but observed in any type of agricultural practice.

Conclusions

This study clarified the relationships between species-richness in the tree line vegetation and the weed pressure in arable zones. It indicates that agroforestry does not significantly increase the weed-pressure, even in systems with a high species richness in plant communities. However, since the analyzed system are very young, the study should be repeated in the future, in order to confirm the result

Keywords
alley cropping, plant species richness, biodiversity

Aditional Attachment II.



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