EFFECTS OF AGROFORESTRY SYSTEMS ON MICROCLIMATE AND WATER AVAILABILITY AS DETERMINANTS FOR SUSTAINABLE SOIL PRODUCTIVITY

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BACKGROUND

Short rotation alley cropping systems (ACS) combine agricultural production with fast-growing trees for energy production purposes. Tree strips in ACS have been found to have beneficial effects on microclimatic conditions in adjacent crop alleys (e.g. reduction of wind speed and air temperature extremes)[1] and may increase the availability of water for crops. Balanced microclimatic conditions and enhanced water availability can improve yield stability and thus, agricultural productivity. In this study, we will investigate how the tree strips in an ACS influence microclimatic conditions and water availability in adjacent crop alleys and how changes in these parameters affect crop yields.

OBJECTIVES

The objectives of this study are to (i.) measure small-scale water availability (soil moisture, potential evaporation, stomatal resistance, water potential), (ii.) measure small-scale microclimate (air temperature, air humidity, wind velocity, global radiation, precipitation) and (iii.) measure small-scale biomass yield in a poplar ACS and a reference site over two consecutive years and for three different field crops.

FIGURE 1 Agroforestry site of study area in Neu Sacro, Brandenburg

STUDY AREA

The main study area is a 70 ha agricultural field in Neu Sacro, Brandenburg, which was in part converted into a short rotation alley cropping system in 2010 (Fig.1)[2]. Both, the ACS and the reference site in close proximity are managed conventionally. The tree strips in the ACS are planted in N-S direction and consist of poplar clone Max 1 (*Populus nigra L.* x *P. maximowiczii)* and Fritzi-Pauley (*Populus trichocarpa)*. Measurements are carried out on two 48 m wide crop alleys which will be cultivated with three different field crops over two consecutive years.

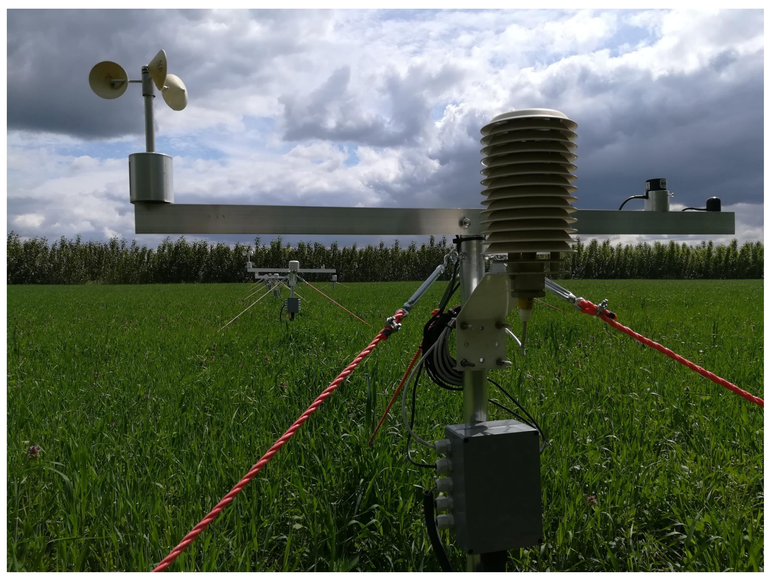

FIGURE 2 Stationary weather station transect

EXPERIMENTAL DESIGN

We use stationary weather stations (Fig. 2) in a predefined transect as well as mobile sensors in four strips running parallel to the stationary transect, which are installed in the ACS at different distances from the tree strips (Fig. 3) and in the reference site. At all measuring points air temperature, air humidity and evaporation according to Piché will be continuously determined. In addition, wind speed, global radiation and precipitation will be measured at the stationary weather stations. Furthermore, transpiration of crops will be determined at different times close to all microclimate points. Subsequent crop yield sampling will then enable us to determine the degree to which tree strips in alley cropping systems influence the microclimate and water availability for the crop at different distances from the tree strip and how these parameters are correlated to changes in small-scale crop yields.

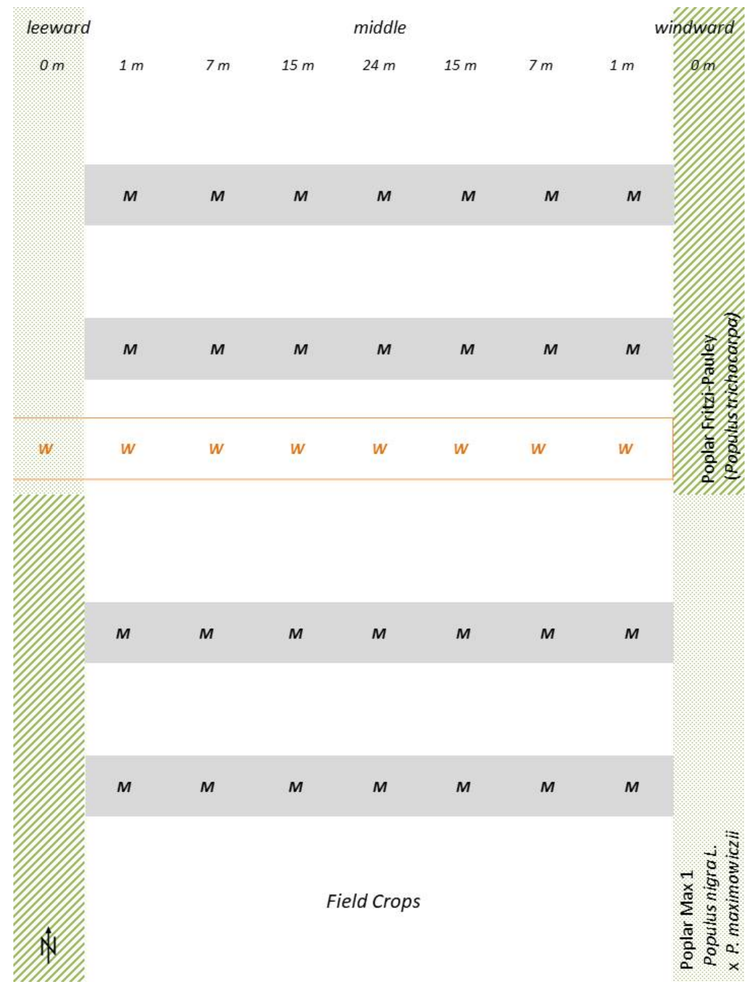

FIGURE 3 Design of field experiment. W: stationary weather stations, M: mobile sensors

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REFERENCES

[1] Böhm C., Tsonkova P. (2018). Effekte des Agrarholzanbaus auf mikroklimatische Kenngrößen. In: Veste M., Böhm C. (eds) Agrarholz – Schnellwachsende Bäume in der Landwirtschaft. Springer Spektrum, Berlin, Heidelberg, pp. 335-389

[2] Böhm, C., Kanzler, M., Mirck, J. & Freese, D. (2015) Effekte agroforstlicher Wirtschaftsweisen auf die Grundwasserqualität von Ackerstandorten. Mitteilungen der Gesellschaft für Pflanzenbauwissenschaften 27: 83-84.

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