



The Impact of Trees on Growth and Yield of Soybean in Poplar Alley-Cropping Systems in the Veneto Region

Anna Panozzo¹, Giuseppe Barion¹, Pietro Ottoboni¹, Manuel Ferrari¹, Alberto Di Stefano¹, Cristian Dal Cortivo¹, Giustino Mezzalana², Teofilo Vamerli¹

¹ Dep. of Agronomy, Food, Natural Resources, Animals and the Environment, Univ. Padova, IT. Corresponding author: anna.panozzo@unipd.it



VENETO AGRICOLTURA

² Agenzia Veneta per l'Innovazione nel Settore Primario – Veneto Agricoltura, Padova, IT.

Introduction

Agroforestry farming models are explicitly mentioned in the draft of the new CAP Strategic Plan Regulation as one of the key practices to achieve the EU Climate Target Plan of climate neutrality in Europe by 2050. In this study we investigated the impact of 3-year old row-arranged poplar trees of two clones differing for the timing of leaf sprouting, on growth, yield and quality of soybean cultivated in the alley, in order to assess the potential of this system to enhance crop resilience to climate change and ensure greater yield stability.

Materials and Methods

The trial was conducted in 2020 at the “Sasse Rami” pilot farm of Veneto Agricoltura Agency in Ceregnano (RO), where an alley-cropping system has been implemented in 2017 with 13 different clones of poplars (*Populus × euroamericana*; one clone per row), planted along drainage ditches 40 m apart. Non irrigated soybean (var. P21T45, Pioneer-Corteva) was intercropped with poplars of two clones differing for the timing of leaf sprouting: medium-late in Mella and early in Aleramo.

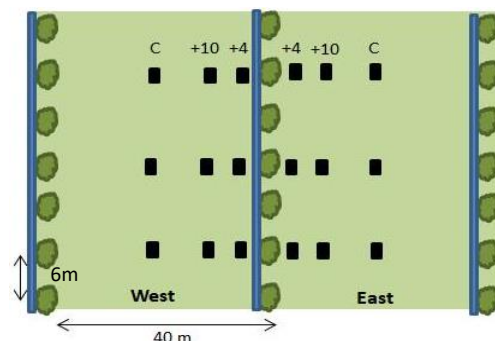


Figure 1. Sampling points along 3 transects

Soybean plants have been sampled at flowering and maturity (1 m² area each) at 3 different distances from the trees i.e., +4, +10 and +20 m (the latter assumed as controls C), along transects (Fig. 1) orthogonally to poplar rows of each clone. LAI, leaf chlorophyll content and biomass were measured at flowering. At maturity grain yield and total isoflavone content (TIC; Hubert et al. 2005) were assessed. Significant differences were detected by R studio (Tukey's HSD test, P ≤ 0.05).

Results

The grain yield of soybean at +10 m from the tree row was equal to unshaded controls (middle of the alley; 490 g m⁻²), with not significant differences between poplar clones, although a slight increase of yield was observed when associated to Aleramo and to west (+16%; P<0.05). In proximity to the tree rows (+4 m), despite a general improvement of the leaf chlorophyll content and leaf/stem biomass ratio (at flowering), and the thousand grains weight (TGW) (particularly with Aleramo; P<0.05), a significant yield reduction (-31% on average) was measured, as compared to controls. Grain yield was correlated with leaf biomass and area (LAI), and the Total Isoflavone Concentration (TIC) (Fig. 2).

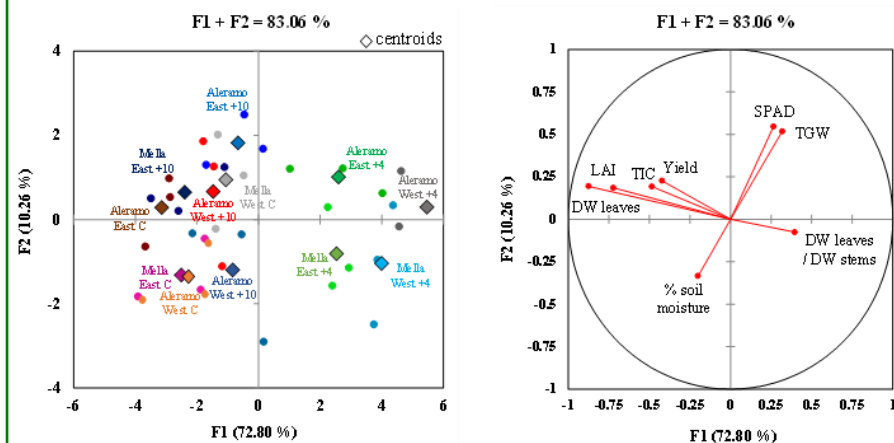
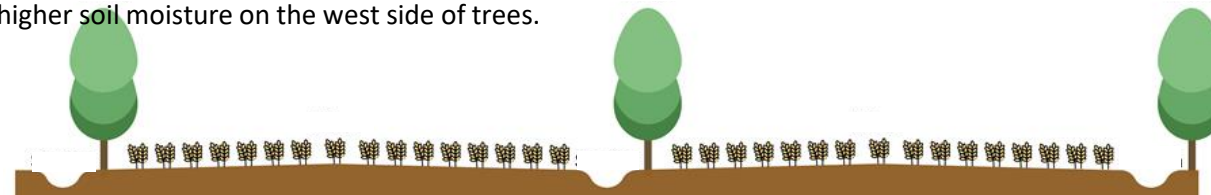


Figure 2. Principal component analysis (PCA, right) and discriminant analysis (DA; left) for two poplar clones, the side of the alley and the distance from the tree row.



Conclusions

The cultivation of soybean intercropped with poplar trees seems a successful strategy to implement resilient and high-yielding alley-cropping systems. Until the third year of poplars growth, it seems that crop yield reduction was restricted to the area neighboring the tree rows (+4 m) and was not linked to water competition with trees or tree phenology. In particular, tree shading allows the maintenance of higher soil moisture on the west side of trees.



References

Hubert J. et al. 2005 Use of a simplified HPLC–UV analysis for soyasaponin B determination: study of saponin and isoflavone variability in soybean cultivars and soy-based health food products. J. Agric. Food. Chem. 53: 3923-3930