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ABSTRACT BOOK

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Editors: Bohdan Lojka, Šárka Hoffmannová

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Phenology, growth and yield of widely spaced 5-year old poplar trees intercropped with maize in northeastern Italy

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Introduction

The demand for poplar wood for industrial uses has progressively increased in recent years, as well as the need for sustainable and resilient farming systems. Silvoarable agroforestry is gaining increasing interest for improving resource use efficiency, increasing C sequestration and resilience to climate change, and enhancing at the same time the use efficiency of natural resources and the overall productivity per land unit (Lawson et al., 2019; Santiago-Freijanes et al., 2018). The cultivation of poplar together with field crops has gained interest among farmers across Europe because this species grows rapidly, generates a relatively fast economical return, it is easy to manage and highly demanded by wood industries. Poplar also allows to minimize tree-crop competition due to its moderate shading canopy that minimize crop yield impairments (Piotto et al., 2024). However, there is little information available on growth and quality of timber when cultivated at low density, and the impact on crop yield still remain uncertain across the commercial cycle of trees.

Objectives

This study aimed at investigating: i) the diameter at breast height (DBH), tree height, radial growth, and leaf phenology of new HES (High Environmental Sustainability) poplar clones, appreciated for their high Tolerance or resistance to pathogens and insects, in an alley-cropping system in comparison with a poplar monoculture plantation; and ii) the yield of maize intercrop at increasing distance from the tree row.

Methodology

Research was conducted in 2023 in Ceregnano (Rovigo, NE Italy, 45° 05’06” N, 11° 87’ 66” W; 0.5-1m a.s.l.) at the “Sasse Rami” pilot farm of Veneto Agricoltura (VA) in an alley-cropping system (AF) and in a poplar monoculture plantation (C) with the same poplar clones of five years of age. In the alley-cropping system (AF) the tree interow is 40 m, N-S oriented, placed along drainage ditches 150 m long, with 6 m of distance between trees along the row, bringing to 35 trees ha-1. The control specialized poplar plantation (C) had a 6 × 6 m planting scheme, with ~277 trees ha-1. During the season, the following tree parameter were investigated: diameter at breast height (DBH), tree height, radial growth, and foliar phenology of clones Aleramo, Tucano, and Moncalvo in both C and AF (n = 27 and 16-23, in C and AF respectively). DBH and tree height were monitored at the beginning of 2023, leaf phenology from 9 March to 19 April using a national phenological scale (Malossini et al., 1993), and radial growth during the vegetative season through dendrometers (Linear Motion Potentiometer, Bourns-3048). At maturity, maize plants were sampled on a 1-m2 sampling area along three transects orthogonal to the poplar rows with 3 replicates, at distances from trees of +3m, +6m and +12m, both at east and west sides of the tree rows, and in the centre of the alley (C, +20m, assumed as reference controls). For each distance × replicate, plants were threshed to determine grain yield, and quality (by NIRS technology). Statistical analysis was carried out with R studio v. 1.4, using the Tukey’s HSD test for means separation ($P \leq 0.05$) and the two-sample t-test ($p \leq 0.05$).

Results

Poplar DBH was significantly higher ($p \leq 0.01$) in AF than in C by 10% on average (24 vs. 22 cm), with the greatest difference in Tucano (27 vs. 23 cm, +15%; $p \leq 0.01$), while no differences were recorded in clones Lena and Moleto. Contrarily, the height of poplars was 9% lower in AF compared to C (14.8 vs. 16.2 m, $p \leq 0.0001$), with the greatest difference observed in Lena (14.2 vs. 16.7 m, -15%), whereas Aleramo and Tucano did not show significant differences (Figure 1). Considering Aleramo, Moncalvo, and Tucano, the fastest growing clones, radial growth in AF were respectively 98%, 93%, and 43% higher ($p \leq 0.001$) as opposed to poplar plantation (Figure 1), while spring foliation was delayed in agroforestry up to one week (Figure 1).

The grain yield of maize decreased significantly ($p \leq 0.05$) in the neighboring of the poplar row, with -32% at +6m and the largest impairment at +3m (-57% vs. C) on the west and -44% on the east sides (Figure 1).

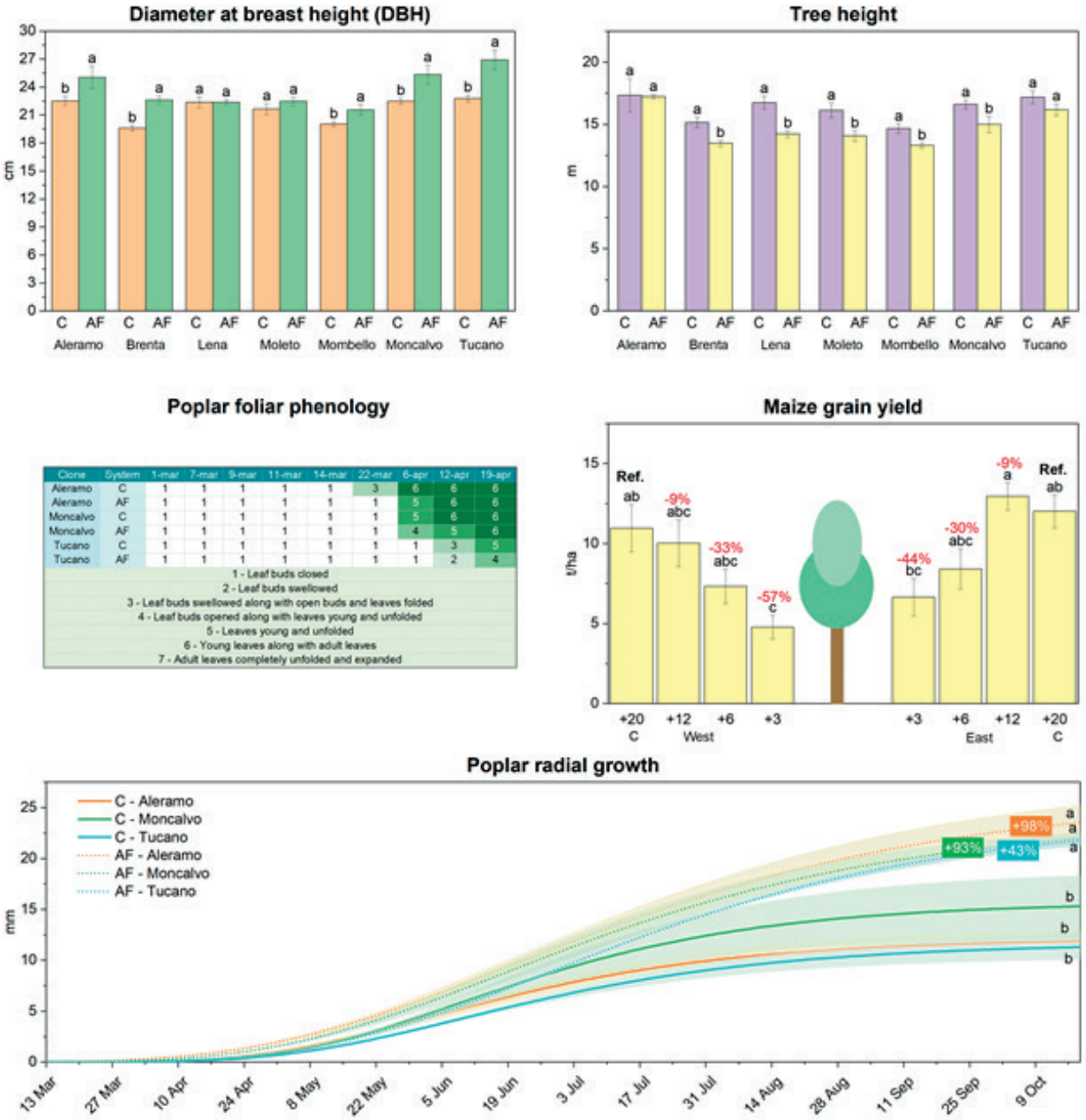
Conclusion

Farmers are currently still reluctant to integrate trees into arable fields because of expected negative impact on intercrop yield and uncertainty on tree growth and timber quality. This study indicates that largely spaced alley-cropping systems with HES poplar clones increase poplar growth DBH, while maize reduces considerably grain yield with 5-year old trees. This suggests including maize as intercrop of arable agroforestry systems in the first years of the poplar cycle only, in order to reduce light competition light competition in this C4 species. Further assessments of poplar HES clones for agroforestry systems in temperate climates should consider the technological properties of wood within a few years at commercial maturity.

Keywords

Specialized poplar plantation, Dendrometers, timber, silvoarable agroforestry, Diameter at breast height (DBH)

Aditional Attachment II.



Bibliography

Lawson G, Dupraz C, Watté J (2019) Can Silvoarable Systems Maintain Yield, Resilience, and Diversity in the Face of Changing Environments? Agroecosystem Diversity: Reconciling Contemporary Agriculture and Environmental Quality 9:145-168. https://doi.org/10.1016/B978-0-12-811050-8.00009-1

Malossini A. (ed.) (1993): Procedure per il rilevamento fenologico nei Giardini Italiani, Gruppo di Lavoro nazionale per i Giardini fenologici, R. Emilia-Romagna, Bologna, 64 pp.

Piotto S, Panozzo A, Pasqualotto G, Carraro V, Barion G, Mezzalira G, Furlan L, Moore SS, Vamerali T (2024) Phenology and radial growth of poplars in wide alley agroforestry systems and the effect on yield of annual intercrops in the first four years of tree age. Agriculture, Ecosystems and Environment 361: 108814. https://doi.org/10.1016/j.agee.2023.108814

Santiago-Freijanes JJ, Mosquera-Losada MR, Rois-Díaz M, Ferreiro Domínguez N, Pantera A, Aldrey, JA, Rigueiro-Rodríguez A (2018) Global and European policies to foster agricultural sustainability: agroforestry. Agroforestry Systems. https://doi.org/10.1007/s10457-018-0215-9