

Towards the silvopastoral management of high quality timber plantation The case of mature walnuts in Mediterranean Spain

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RATIONALE

Europe needs high quality wood. In the last decade, intensive hardwood plantations, based on high levels of energy consumption and chemical inputs, have substantially increased in many Spanish regions. However, periodical harrowing and the use of herbicides and mineral fertilizers are controversial management practices. Silvopastoral management could allow reducing the economic costs of these plantations and optimize their overall environmental services.



AIMS

Here we present preliminary results of the Spanish project SILVOMAD (Silvopastoral management for quality wood production: functional basis, productivity and environmental services) where,

in colaboration with the company BOSQUES NATURALES (www.bosques-naturales.com/), we evaluate the response of intensive walnut plantations to alternative methods to control the competing herbaceous understory and to replace the mineral N fertilization by sown of leguminous pastures that, at the same time, would reinforce time the pastoral value of the system.



METHODS

- In an intensive walnut plantations (3-4 harrowing per years of alleys, 2-3 herbicide application per year in the tree lines, and fertirrigation) two parallels trials were initiated in 2011 to check the advantages of a silvopastoral, environmental-friendly management.
- In the first trial we compare 3 methods of control of herbaceous understory Harrow, Brushcutter, Grazing.
- In the second trial we compare 3 methods of control of fertilization: mineral-N Fertilization, mix of Legume sown and Control (no N fertilizer).
- These treatments were combined factorially with different doses of irrigation (W1 to W3, with 1 to 3 lines of drip irrigation), to respond to the ongoing concern of water shortage and water competition among trees and understory herbs in Mediterranean agroforestry systems.
- Soil nutrient availability and the temporal dynamic of soil moisture profile are measured. Along vegetative period, the physiological (photosynthetic rate, photochemical efficiency and water potential) and nutritional status of tree leaves are measured periodically. Annual growth of tree diameter is also assessed.

Additionally, the possible reinforcement of C storage in the soil and the mitigation of soil nitrate and phosphate leaching are monitored.

PRELIMINARY RESULTS

After 12 years of intensive management, the change to alternative management did not have any significant effect on the water status of the walnuts in the first year. The mean leaf water potential (Ψ =-1.5 ± 0.1 MPa, averaged from July to September and from early morning till the afternoon), was also irrespective of the dose of irrigation. Only with the lower dose of irrigation, trees without control of understory herbs showed Ψ marginally lower. CO₂ assimilation rate (*A*) depended marginally of dose of irrigation, with lowest *A* values in W1. While in W1 the lowest mean value of *A* was recorded in grazed plots, increasing irrigation dose (R3), *A* trended to be higher in grazed plots than in other treatments (Table 1). Results of photochemical efficiency indicate that walnuts did not experienced important stresses, irrespectively of the treatment, although slight but significant differences were detected (Table 1). The sown of leguminous forage worsened slightly the state of walnut leaves, while with grazing walnuts maintained very high values of Fv/Fm.

Although in this first year, the increment of the tree diameter (0.5 cm y¹) was not affected by management practices, slight differences in the physiological parameters could indicate a potential slowing of the tree growth at the long term with the silvopastoral management here tested, which could be prevented increasing the dose of irrigation.



Mean values (25.E.) or CO2 assimilation rate and photochemical enclorely in values with dimeterit types or reminiation and com understory, combined with three regime of irrigation (1 = obsect), 2 = highest). Different letters indicate significant differences (p=0 among combinations of treatments (Treatment x Irrigation).

FIRST IMPRESSIONS

At short term, trees were only marginally affected by different treatments applied. Moreover, slight worsening of physiological status of walnut leaves with legume sown and with grazing were compensate with higher dose of irrigation. Harrow and fertilization did not improve significantly leave status and functioning, although affected slightly and significantly tree growth.







NEXT STEPS

We are evaluating the efficiency of alternative techniques to mitigate nitrate and phosphorus leaching and to reinforce carbon sequestration into the soil.

A detailed economical of different alternatives is also in course, to check if the presumably slight reduction of tree growth with silvopastoral management is compensate with the reduction of the costs and the increment of the annual incomes (livestock).



