

HYBRID WALNUT (*JUGLANS MJ209*) FOR TIMBER PRODUCTION IN AN AGROFORESTRY SCHEME: SOME EXPERIENCES LEARNT IN SPAIN

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Abstract

The models of hardwood production in Europe have been under evaluation for the last 20 years with different experiences of plantation frameworks, pure or mixed species production and different agroforestry models. The communication explores the experiences of the company Bosques Naturales SA regarding different approaches to the management of walnut trees associated to agroforestry systems and how the company transitioned from the “pure” forest plantations established around 20 years ago to the agroforestry management perform nowadays. Work is currently being carried out on the Woodnat Second Generation of Planted Hardwood Forest in the EU with the evaluation of the different systems and the intention of providing the best production models presenting the lessons learned.

Keywords: walnut plantations; silvopastoral; silvoarable; wood quality production

Introduction

Walnut trees are species of the genus *Juglans* sp. L., traditionally characterized by their highly valued nuts and timber. The main walnut species are Persian walnut (*Juglans regia* L.), also known as European, English or Common walnut, and American or Black walnut (*Juglans nigra* L.) and different hybrids between them and/or other species. In addition, many clones have been selected during recent decades to improve timber production. During the last decades, many forest plantations oriented for timber production have been established with Hybrid or with Persian Walnut in Europe, which are usually intensively managed and allow managers to sustain relatively high growth rates. Timber is in most of the cases the main economic income in a walnut (*Juglans* sp.) forest plantation such as the ones that have been treated along the WOODNAT project. Walnut timber has been traditionally highly appreciated and mainly used for furniture, flooring and paneling. It generally has two main uses: wood veneer and sawn wood. However, some other uses have been explored to obtain the maximum profit from either small trees or big trees with irregular shapes: carefully designed small objects (art, fashion, kitchen and decoration) and slabs tables (Figure 1).



Figure 1: Details about different uses of walnut (*Juglans* sp.) wood: carefully designed small objects (art, fashion, kitchen and decoration) and slabs tables (more details in www.woodna.es).

Agroforestry systems is a name used to described a continuum of systems varying from the ones obtained by planting trees on agricultural or pasture land or introducing agriculture or pasture in existing woodland/orchards. Hence, even though here agro-forestry systems are considered as a different system from the others, it is more a concept of the integration of the different objectives and approaches into a system. To this respect, depending on the considered conceptual framework, the same agroforestry system of walnut trees planted on the field associated with other agronomic uses might be considered as a forest plantation with an associated secondary use of pasture or crop or a crop or pasture farm which has introduced some trees to benefit from their environmental and socio-economic advantages.

Walnut silvopastoral systems: sheep as “gardeners”

Weed control is one of the main management issues in a “pure” forest plantation and one of the most important expenses. Traditional weed control techniques are mechanical (e.g. ploughing between the plantation lines) and chemical (using herbicides between the plantations lines and between trees in the lines). Hence, grazing animals in the plantations turns the negatively considered “weeds” into positively valued pasture used under a silvopastoral system approach.

To this respect, the company Bosques Naturales SA participated years ago in several research projects (in collaboration with Universidad de Santiago de Compostela and Universidad de Extremadura) to evaluate the effect of sheep grazing on their planted forests. After these research experience, the company has embraced the silvopastoral approach and sheep grazing is used in most of the farms from the company. Indeed, the company has incorporated sheep grazing as one of their commercial activities in Galicia (NW Spain) (Figure 2), while it is performed in collaboration (rental approach) with independent shepherds in the farms from Cáceres and Toledo (Central Spain).



Figure 2: Sheep grazing under hybrid walnut (*Juglans x intermedia*) planted forests in Galicia (NW Spain), from the company Bosques Naturales SA.

Walnut silvoarable systems: maize in humid areas of NW Spain

An important drawback when considering the investment in a forest plantation is the long-term approach as a big investment needs to be done in the establishment of the plantation and the management along many years until the timber harvesting gives back the financial profit.

Walnut “pure” forest plantations have been traditionally established with tree densities around 300-400 trees ha⁻¹ in regular spacings (e.g. 5 x 5 m, 5 x 6 m, etc.). However, establishing the plantations with a lower density makes them compatible with a silvo-arable system approach which, in addition to some environmental advantages (and reducing the weeding expenses), it gives a yearly profit from the annual crop.

To this respect, every new plantation of the company Bosques Naturales SA since some years ago is established with this silvoarable approach (Figure 3). This system consists in maize with sparse hybrid walnut (222 trees ha⁻¹) with pairs of 2 plantation lines spaced 6 m (with 5 m distance between trees in the same line) separated by bigger clearances for agriculture of 12 m wide. In this system, the 6-m corridor between the plantation lines allow managers to work within the trees without make any disturbances to the agricultural fields.

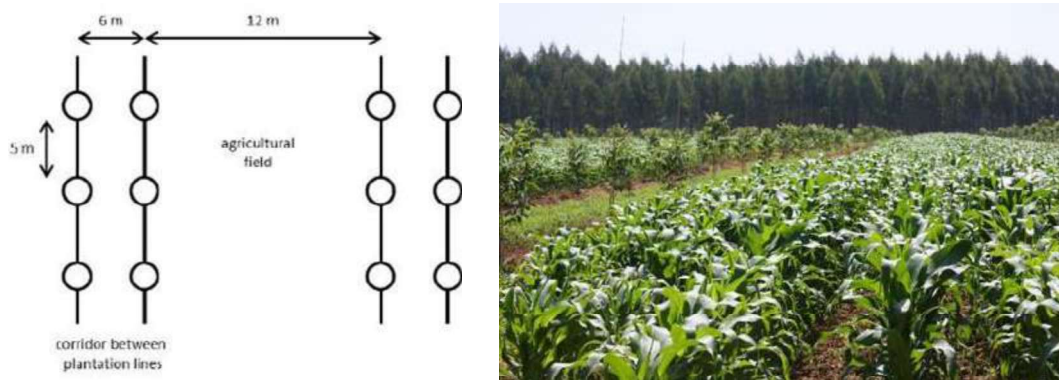


Figure 3: On the left, scheme proposed for an agroforestry system including sparse walnut (*Juglans* sp.) planted forests and on the right, details from an agroforestry system combining maize (*Zea mays* L.) and hybrid walnut (*Juglans x intermedia*) in the Bosques Naturales farm in Galicia (NW Spain).

Walnut silvoarable systems: cereal crops below tree cover in Mediterranean areas

Considering the above-mentioned benefits from the silvo-arable approach, cereal intercropping has been also tested in research projects (in collaboration with Universidad de Santiago de Compostela, Universidad de Extremadura and Centro Tecnológico Forestal de Cataluña) between the 5-6 m wide plantation lines in the “pure” forest plantations originally established during the first years of the company. These research projects have showed that cereal harvests are good enough below the shadow of the planted forests and, in some cases, better than in the open conditions. This is especially relevant in the Mediterranean areas with long dry-hot periods.

These between rows intercropping approach shows some positive results as a good harvest and a weed control expenses reduction. However, it has a major inconvenient regarding agricultural machinery used for the agricultural crops. Hence, even though the 5-6 m wide space between the plantation lines result in a planted forest with relatively low-density from a forest perspective, it is very narrow for working with the common agricultural machines and, consequently, this practice has not been adopted in the routine management of Bosques Naturales. However, it might be considered in the establishment of new plantations in Mediterranean areas with wider between lines spacing which may allow the work of common machinery.

The importance of being clonal

Select the right plant source is one of the main issues once one has decided to establish a new walnut plantation in a site. Even though plenty of options could be available depending on the budget and dimensions, the plant quality and the genetic potential should be considered as one of the key investments when establishing a commercial planted forest.

The management experience in walnut planted forests shows how a good plant material from a seed orchards planted in relatively homogeneous site turn out in a forest where differences between trees are much larger than expected both in shape and size (e.g. in a 19 years old hybrid walnut planted forest established from good quality plant material from seeds is relatively common to find trees with diameter around 15 cm adjacent to ones with around 35 cm and very different shapes, while 13 clonal plantations in Galicia have a very homogeneous growth, with average diameter of 20 cm and good shape).

When the silvicultural scheme is changed and the tree density is reduced to follow a silvo-arable approach, there is a need of ensuring that, as your plantation has fewer trees, they need to be of much better quality. To this respect, the use of clones are highly recommended when walnut are planted under agro-silvo-pastoral approaches.

The balance between agroforestry uses, timber market prices and tree density

Walnut planted forests have usually been established with a relatively low density (around 300-400 trees ha⁻¹) where only 1 or 2 thinnings are needed in order to harvest around 100-150 trees ha⁻¹ at the end of the rotation period. These 1 or 2 thinnings have been usually considered as “commercial thinnings” as the removed trees would have a marketable diameter at breast height (15-25 cm) which would turn the thinnings into small incomes prior to the main harvest of the plantation. However, market prices and interests are very variable and fluctuates a lot depending on final-consumer demands. Indeed, during recent years the market demand has been lower than expected and these “commercial thinnings” that were regarded as an intermediate small income by many forest managers had turned into investments needed in order to achieve in the future the objectives fixed for the final harvest at the end of the rotation period. Hence, the expected market price is a key issue regarding the initial establishment of a planted forests as the idea of a thinning regarded as an income or as an investment would directly influence the decision about the initial tree density planted at establishment. To this respect, a financial balance needs to be done and evaluate if having a denser plantation where

you are going to have 2 thinnings is more or less profitable than establishing fewer trees and have a yearly income from companion crop.

New perspectives

Projects are being considered for the management of agroforestry systems based on walnut trees for timber. Hence, intercropping with medicinal and aromatic crops are being considered, as well as mushroom and truffle harvesting.