

The Effect of Intercrop on Soil Properties of an Agroforestry System in Kea - Greece

Pantera A.^{1,*}, Papadopoulos A.¹, Fotiadis G.¹, Kapsalis D.², Papaporfyriou P.², Papaspyropoulos K.²

¹Agricultural University of Athens, 36100 Karpenissi, Greece

²Forestry and Natural Environment, Aristotle University of Thessaloniki, Thessaloniki, Greece

*corresponding author: e-mail: pantera@aau.gr

Abstract

Valonia oak is the most widespread tree species found in the Aegean island of Kea - Cyclades. It forms traditional agroforestry systems since intensive agriculture is not easily practiced in the island due to the xerothermic climate and the rough terrain with steep slopes. This system has traditionally supported the local economy by its multiple products while respecting the environment. In almost all the cases, it is found in traditional terraces which were constructed since ancient times by local farmers. Even if these systems have been threatened by abandonment and change of land use (mainly for touristic purposes), there has been an increasing interest lately motivated by the higher price gained by valonia oak acorns trade and demand for agrotouristic activities. An experimental plot was established under the framework of the AGFORWARD (FP7) research project, where two commercial pasture mixes were tested for their productive capacity under shade. Soil properties were evaluated at the end of the experiment to evaluate the effect of intercropping on the economy of certain nutrients. The importance of the environmental and economic function of this system is highlighted and suggestions are made for its preservation.

Keywords: nitrogen, pH, nutrients, *Quercus ithaburensis* subsp. *macrolepis*

1. Introduction

Valonia oak (*Quercus ithaburensis* subsp. *macrolepis* (Kotschy) Hedge & Yalt.) forms traditional silvoarable agroforestry systems in the Aegean island of Kea – Cyclades, Greece. It spreads mostly in the central and eastern side of the island, in traditional terraces. The species presence in the Island of Kea has resulted from its natural distribution in the Aegean islands (Tutin et al. 1993; Strid and Tan 1997), but may as well have been introduced by farmers for agricultural use. Ownership is private to local stakeholders. In certain farms, valonia oak is used for grazing rendering it a silvopastoral system or an agrosilvopastoral one as livestock is removed for a certain time of the year. Valonia oak tree forms agroforestry systems of high natural and cultural value (Der Herder et al. 2015), since they combine agriculture, forestry and range management practices for production, using traditional practices. Most of these areas are formed in

terraces as it is common in most Aegean islands, due to the steep terrain. Agrosilvopastoralism is a main land use system on Kea island which is practiced today by only few local farmers. In the past, the valonia oak trees used for collecting cups for tanneries. Furthermore, from pruning the mature trees, which was performed mainly for the production of acorns, firewood was also collected for household use and charcoal. Parts of the fields with valonia oak trees with more fertile soils were cultivated with grapes, almonds trees and periodically by cereals and other forage plants to produce marketable crops and supplementary fodder for the animals that can be used in winter period. Livestock mostly composed of sheep, goats and less from cattle and pigs simultaneously grazed these areas with time limitations to those that could be cultivated. The abandonment of these traditional uses, led to the depreciation of valonia oak. Many traditional fields with valonia oak trees and livestock farming systems were abandoned resulting to their forestation and encroachment. In other occasions they have been converted to summerhouses and tourist resorts due to the high value of the land for this uses. However, lately there has been an effort in the island, as in other regions with valonia oak forests, to recover these uses as an attempt to revive agricultural economy as well as for ecological purposes, (Pantera et al. 2015). An experiment was established in order to examine the possible relation of trees and different legume species on certain soil properties.

2. Material and Methods

The experimental site was located in a representative of the Kea island private farm (agrosilvopastoral system) in a private farm of 0.12 ha, in the Kea island of Cyclades (Aegean sea). Within the field, 30 experimental plots of 1x1 m were randomly selected. The treatments included sowing of two different mixtures including up to nine forage legume species (ISPAAM and FERTIPRADO). The control included natural vegetation. For each treatment there were selected similar shaded and open to natural light positions. Both mixtures were fertilized with 144 kg ha⁻¹ of monopotassium phosphate 0-52-34 before seeding. The experimental plots were fenced for protection from grazing. The factors evaluated included

soil pH, organic matter, nitrogen (%) and phosphorus (ppm) content.

3. Results - Discussion

The two-way factorial ANOVA showed that there is a significant difference among the levels of handling for the dependent variable of nitrogen (N) measured in %. The percentage of N is significantly less in the control area compared to ISPAAM. There are no significant differences between FERTIPRADO and Control and FERTIPRADO and ISPAAM. The two-way factorial ANOVA showed that there is a significant difference among the levels of handling for the dependent variable of phosphorus (P) measured in ppm. P content (in ppm) was significantly less in the control area compared to ISPAAM. There are no significant differences between FERTIPRADO and Control and FERTIPRADO and ISPAAM. No differences were recorded for organic matter content or soil pH.

References

- Den Herder M., Burgess P. Mosquera-Losada M.R., Herzog F., Hartel T., Upson M., Viholainen L. and Rosati A. (2015), Preliminary stratification and quantification of agroforestry in Europe. Milestone 1 for EU FP7 Research Project: AGFORWARD 613520, 53 pp., <http://www.agforward.eu/index.php/en/news-reader/id-28-april-2015.html>
- Pantera A, Papadopoulos A, Mantzanas K, Papanastasis V.P., Fotiadis G, Vrachnakis M, Alifragis D, Ispikoudis I, et al. (2015) The contribution of valonia oak silvopastoral systems in Western Greece to local development and the environment. In: Lekkas TD (ed) Proceedings of the 14th International Conference on Environmental Sciences and Technology, CEST-2015_00100, Rhodes, Greece, 3-5 September 2015

4. Conclusions

Shading from valonia oak tree canopy had no specific effect on certain soil parameters for the different commercial mixtures but even favored N soil economy in a certain occasion. This indicates that these commercial mixtures can be used for the improvement of xerothermic grasslands with valonia oak widely present in the island of Kea. The presence of trees, not only cannot be considered as hindering pasture production but positively contribute and provide numerous ecosystem services which are necessary for the protection and better functioning of valonia oak agrosilvopastoral systems in the island of Kea.

Acknowledgment

This research was realized within the AGFORWARD project (Grant Agreement N° 613520) and has been co-funded by the European Commission, Directorate General for Research & Innovation, within the 7th Framework Programme of RTD, Theme 2 - Biotechnologies, Agriculture & Food and by the Hellenic Ministry of Education, Research and Religion, General Secretariat for Research and Technology.

- Strid A. and Tan K. (1997, 2002), Flora Hellenica Vol. 1-2. Koeltz Scientific Books, Königstein
- Tutin T.G., Burges N.A., Chater A.O., Edmondson J.R., Heywood V.H., Moore D.M., Valentine D.H., Walters S.M. and Webb D.A. (1993), Flora Europaea, 2nd ed Vol 1, Cambridge University Press, Cambridge, p 581