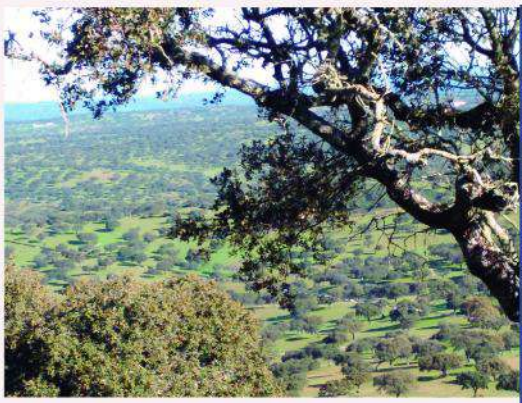
EURAF
EUROPEAN AGROFORESTRY FEDERATION

4th EUROPEAN AGROFORESTRY CONFERENCE

"Agroforesty as Sustainable Land Use"

CONFERENCE PROCEEDINGS



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Agroforestry as Sustainable Land Use

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Foreword

It is a great pleasure to share with you the excellent book of abstracts of the 4th European Agroforestry Conference carried out in the beautiful city of Nijmejen (The Netherlands) during the European Green Capital 2018. The book is plenty of extraordinary information and experiences about agroforestry practices and systems around the world including Africa, America and Europe. Silvopastoralism is the most relevant agroforestry practice shown in the book, but also silvoarable or alley cropping practices become important. Sessions and topics deal with the enhancement of productivity of both the woody perennial and the lower storey component of the agroforestry practice trying to cope with an increasing primary sector products demanded by the world, but also highlighting the importance of the ecosystem services delivery and considering the fulfillment of the United Nations Sustainable Development Goals. The importance of agroforestry as one of the best tools available to mitigate and adapt to climate change is also discussed in different papers. Biodiversity preservation and enhancement through locally adapted agroforestry practices is also tackled as well as water and soil quality and health. Social aspects and innovation promotion, needed to successfully reach the necessary transition towards an extensive use of agroforestry, are also outreached in several papers. The needed change of international, national, regional and local policies is described as a mean to provide insights to foster the transition to agroforestry practices spread. As President of EURAF, I wish you a successful 4th European Agroforestry Conference and an enjoyable reading!

Rosa Mosquera-Losada

President of EURAF

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FEEDING VALUE OF DIFFERENT PLANT FUNCTIONAL TYPES OF OAK MEDITERRANEAN ECOSYSTEMS

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Abstract

The aim of the study was to assess the seasonal variation of Crude protein (CP) and In vitro organic matter digestibility (IVOMD) of key plant functional types (PFT's) present in oak Mediterranean ecosystems of the North of Portugal. The PFT's were legume, spiny and aromatic for shrubs and sclerophyllous, deciduous and coniferous for trees. PFT's varied in crude protein (CP: 4.16- 15.87% DM) and in digestibility (IVOMD: 34.48-63.36%, $p<0.001$). Legume showed the highest CP and the IVOMD, coniferous showed the lowest CP content and aromatic showed the lowest value of IVOMD. In terms of the capacity of these PFT's to suppress the protein needs of livestock animals considering goats of 45 Kg body weight in dry periods (summer and autumn), the coniferous group alone can't cover the needs for maintenance. In the case of late pregnancy, only legume and deciduous and spiny can cover it.

Keywords: goats; late pregnancy; maintenance North of Portugal; protein needs

Introduction

Different reasons motivate the growing interest for trees and shrubs as fodder for ruminants in the Mediterranean region. They are useful sources of cheap feed for ruminant animals, especially during dry or cool seasons when conventional forages are scarce and of low quality (Olafadehan and Okunade 2018). Further, livestock farmers experience increased food insecurity because of climate change and tree fodders and shrubs resilience to variability in weather patterns (Dawson et al. 2014). However, amongst ligneous species there is a great variability on their feeding value, since the proportion between contents (protein, sugars, starch) and cell walls (cellulose, hemicellulose, lignin), the production of secondary metabolites (phenols, tannins) and other defence mechanisms (thorns) against herbivory depends on the ecological strategy of the plant which influences their chemical composition. For instance, the leaf nitrogen and lignin contents were related with the leaves longevity (Grime et al. 1996). The aim of the study was to assess the seasonal variation of Crude protein (CP) and In vitro organic matter digestibility (IVOMD) of key plant functional types (PFTs) present in oak Mediterranean ecosystems of the North of Portugal. The functional groups were legume, spiny and aromatic for shrubs and sclerophyllous, deciduous and coniferous for trees.

Materials and methods

The study was carried out in Trás-os-Montes, Northeast of Portugal. The species studied were *Quercus pyrenaica* Willd., *Quercus faginea* Lam., as deciduous trees, *Quercus suber* L., *Quercus ilex* L. as sclerophyllous trees and *Juniperus oxycedrus* L. as coniferous trees; *Cytisus scoparius* L., *Cytisus striatus* (Hill) Rothm. and *Cytisus multiflorus* (L'Hér.) Sweet, as legume shrubs, *Genista falcata* Brot., as spiny shrubs, *Lavandula stoechas* L. and *Cistus ladanifer* L. as aromatic shrubs. Samples of the different species were taken along the seasons, In the spring,

in April, July in the summer, November in autumn and February in winter. Three samples from each species per location and season were collected, from five randomly selected plants. Samples were air-dried to constant weight in a fan-assisted oven at 60°C for 48h and they were ground in a mill through a 1-mm sieve. Crude protein contents (CP) were evaluated and recorded following the methods of AOAC (1997). In vitro organic matter digestibility (IVOMD) was evaluated using the two-stage technique (Tilley and Terry 1963, modified by Marten and Barnes 1980). CP and IVOMD were analysed by ANOVA (Proc GLM procedure, for the factors "PFTs" and "sampling date") using the SAS (2001) software. Turkey's test was used for subsequent pairwise comparisons ($p \leq 0.05$; $\alpha = 0.05$).

Results

PFTs varied widely in crude protein (CP: 4.16- 15.87% DM) and in digestibility (IVOMD: 34.48 - 63.36%, $p<0.001$) (Figure 1). Legume showed the highest CP and the IVOMD, coniferous showed the lowest CP content and aromatic showed the lowest value of IVOMD. CP and IVOMD parameters were significantly influenced by mature stage of plants ($p<0.001$), being the highest values found in spring. The conifers leave this pattern, showing the highest value of IVOMD in autumn (55.05% DM).

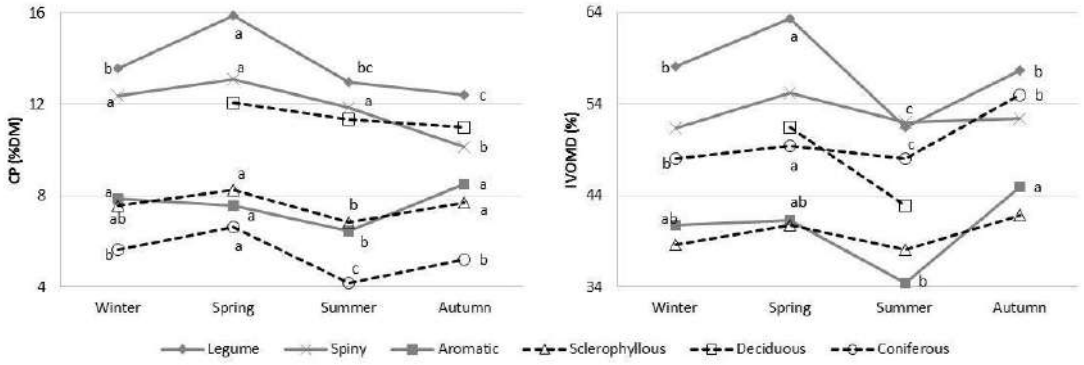

Figure 1: Crude protein content (CP) and In vitro organic matter digestibility (IVOMD) in different functional groups of trees (deciduous, sclerophyllous and coniferous) and shrubs (legume, spiny, and aromatic). Different letters indicate significant differences between seasons in the same functional group.

Discussion

PFTs place a species in a group, the members of which have similar functional attributes (Solbrig 1993). In our study, we considered the N leaves (CP) and the proportion between contents and cell walls (IVOMD). Concerning CP, 4 groups were found, being the legume the one which showed the highest value of CP and the coniferous the one which presented the lowest. One of the other groups is composed by deciduous and spiny, and the other one is composed by sclerophyllous and aromatic. Regarding IVOMD, 4 groups were also found, but different from the first: legume, followed by coniferous and spiny, deciduous, and finally sclerophyllous and aromatic. Feeding value of PFTs showed a great variation between them and along the year. Legume and deciduous and spiny seem a good fodder resource set particularly in periods of food shortage, while the sclerophyllous and aromatic is a poor group in quality of fodder. Also, unfortunately, it is in the summer (dry season), when pastures are very scarce, that their values are at their lowest.

In terms of the capacity of these PFTs to suppress the protein needs of livestock animals considering for instance goats of 45 Kg body weight (7.2% and 11% of DM Intake, NRC 2007), in dry periods (summer and autumn), the coniferous group alone can't cover the needs for maintenance. In the case of late pregnancy, only legume and deciduous and spiny can cover it.

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