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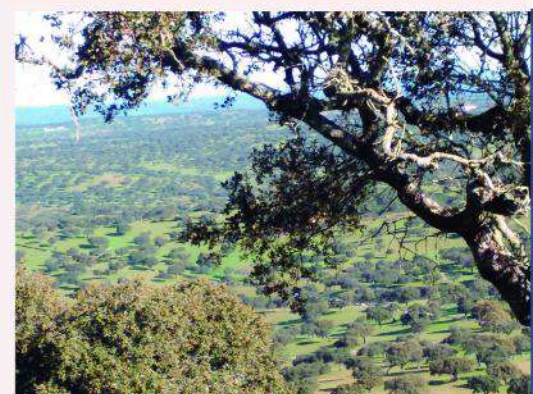
EUROPEAN
AGROFORESTRY
FEDERATION



4th EUROPEAN AGROFORESTRY CONFERENCE

“Agroforestry as
Sustainable Land Use”

CONFERENCE PROCEEDINGS



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Nuria Ferreiro-Domínguez
María Rosa Mosquera-Losada

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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 Nijmegen (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

TABLE OF CONTENTS

Keynotes

We have a dream: fostering agricultural transition towards agroforestry	
<i>Mosquera-Losada MR</i>	1
Recent advance in agroforestry: in support of transition from conventional to climate-resilient farming	
<i>Nair PKR</i>	6
Current and future Common Agricultural Policy	
<i>Hodosi R, Szedlak T</i>	10

Factors of success and failure in the transition into agroforestry

Oral Presentations

Sustainable land resource management with agroforestry: empirical evidence from the Sunyani West District of Ghana, West Africa	
<i>Ashiagbor G, Oduro W, Thevathasan N, Gordon A, Gray R, Hambly Odame H</i>	12
Trees to avoid or trees to support the use of fertilizers on crops?	
<i>Breman H</i>	17
Agroforestry systems in Romania	
<i>Mihăilă E, Costăchescu C, Dănescu F, Popovici L</i>	21
Benefits of agroforestry systems for land equivalent ratio – case studies in Brandenburg and Lower Saxony, Germany	
<i>Seserman DM, Veste M, Freese D, Swieter A, Langhof M</i>	26
Hybrid walnut (<i>Juglans MJ209</i>) for timber production in an agroforestry scheme: some experiences learnt in Spain	
<i>Urban I, Fernández-Moya J, Licea R, Santacruz D, Gutiérrez-Tejón E</i>	30

Poster Presentations

Using a system innovation's approach for stimulating agroforestry adoption	
<i>Cuperus F, Schoutsen M, Sukkel W, Selin Noren I, Wijnands F</i>	35

Constraints towards organic conversion in agroforestry systems: the case of dehesa livestock farms in Extremadura (SW Spain)	
<i>Horrillo A, Elghannam A, Gaspar P, Escribano M, Mesías FJ</i>	40
Exploring the economic potential of two food forest farms in The Netherlands	
<i>Oosterhof G, Masselink S, Van Dorp D, Van Dooren N, Eweg R, Stobbelaar DJ</i>	45

Costs and revenues of agroforestry on the scale of the individual farm, a region and a state; proven practice and theoretical models

Oral Presentations

Comparison of the profitability of an arable rotation, a monoculture olive system and a silvoarable system in Greece using the Farm-SAFE model	
<i>Baron G, Giannitsopoulos M, Pantera A, Graves A, Burgess</i>	49
LIFE Regenerate project: revitalizing multifunctional Mediterranean agrosilvopastoral systems using dynamic and profitable operational practices (LIFE16 ENV/ES/000276)	
<i>Mesías FJ, Moreno G, Kallen S, Sonneveld E, López-Sotelo J</i>	53
Exploring the potential of agroforestry integration in arable and dairy farms in The Netherlands – an ex-ante assessment at field and farm level	
<i>Prins E, Groot J</i>	58
Integrating a financial module in the Web-EcoYield-SAFE model for bioeconomic assessment of agroforestry ecosystems	
<i>Tomás A, Palma JHN, Graves A, García de Jalón S, Burgess PJ</i>	64
High-resolution economic evaluation of black walnut alley cropping against the maize-soybean rotation in the Midwest USA	
<i>Wolz KJ, DeLucia EH</i>	68

Poster Presentations

Agroforestry network in Brabant, The Netherlands: how farmers develop a new sustainable and economically rentable farming system and how they can contribute to regional ecosystem functions	
<i>Rombouts P, Luske B, Vonk M, van Veluw K</i>	72

Agroforestry policies

Oral Presentations

Agroforestry in Switzerland – a non CAP European country	
<i>Herzog F, Szerencsits E, Kay S, Roces-Diaz JV, Jäger M</i>	74
Adoption of agroforestry options in land use policy measures in Northern and Southern Ireland	
<i>McAdam J, Curran E</i>	78
The political consequences of the implementation of “greening”. A case study in France	
<i>Magnin L</i>	82
Agroforestry within the Pillar I: including woody perennials in Pillar I lands to foster sustainability	
<i>Mosquera-Losada MR, Santiago-Freijanes JJ, Aldrey JA, Ferreiro-Domínguez N, Pantera A, Rigueiro-Rodríguez A</i>	87
Agroforestry policy development in the USA and Europe	
<i>Ormsby Mori G, Mosquera-Losada MR</i>	92

Poster Presentations

Agricultural wood as an ecological focus area: conventional German farmers’attitudes	
<i>Drittler L, Theuvsen L</i>	96
Agroforestry can mitigate environmental problems in European agricultural deficit areas	
<i>Kay S, Roces-Díaz J, Crous-Duran J, Giannitsopoulos M, Graves A, den Herder M, Moreno G, Mosquera-Losada MR, Pantera A, Palma J, Szerencsits E, Herzog F</i>	101
Agroforestry definitions and practices for policy makers	
<i>Mosquera-Losada MR, Santiago-Freijanes JJ, Moreno G, den Herder M, Aldrey JA, Rois-Díaz M, Ferreiro-Domínguez N, Pantera A, Rigueiro-Rodríguez A</i>	104
Agroforestry and the environment in the future European CAP	
<i>Mosquera-Losada MR, Santiago-Freijanes JJ, Aldrey JA, Rois-Díaz M, Ferreiro-Domínguez N, Pantera A, Rigueiro-Rodríguez A</i>	108

Rural development as Pillar II to foster agroforestry	
<i>Mosquera-Losada MR, Santiago-Freijanes JJ, Aldrey JA, Rois-Díaz M, Ferreiro-Domínguez N, Rigueiro-Rodríguez A</i>	112
Linear woody features on homegardens in European Union	
<i>Santiago-Freijanes JJ, Aldrey-Vázquez JA, Rigueiro-Rodríguez A, Mosquera-Losada MR</i>	116
Homegardens: agriculture in the city as an agroforestry practice	
<i>Santiago-Freijanes JJ, Mosquera-Losada MR, Aldrey-Vázquez JA, Rigueiro-Rodríguez A</i>	122

Agroforestry as a form of sustainable land use to fight against climate change

Oral Presentations

Shade increases cereal production in Mediterranean conditions facing the climate change	
<i>Arenas-Corraliza MG, López-Díaz ML, Moreno G</i>	127
Quantifying C stocks in high-yield, short-rotation woody crop production systems for forest and bioenergy values and CO ₂ emission reduction	
<i>Coleman B, Bazrgar A, Sidders D, Gordon A, Thevathasan N</i>	132
Using EcoYieldSAFE to compare soil carbon dynamics under future climate in two contrasting agroforestry systems	
<i>Palma JHN, Crous-Duran J, Graves AR, Garcia de Jalon S, Upson M, Oliveira TS, Paulo JA, Ferreiro-Domínguez N, Moreno G, Burgess PJ</i>	137
How important is adapting regional climatic projections to the local environment? A procedure for microclimatic corrections makes the difference for crop growth in a virtual experiment	
<i>Reyes F, Gosme M, Blanchet G, Dupraz C</i>	141
The effect of a young alley cropping system on soil microclimate	
<i>Vityi A, Kiss-Szigeti N, Marosvölgyi B</i>	146

Poster Presentations

Hedgerow agroforestry in England and Waller: increasing width to sequester additional carbon	
<i>Axe MS, Grange ID, Conway JS</i>	151

Temporal comparison of greenhouse gas emissions between four different riparian land-use types in Southern Ontario, Canada	
<i>Baskerville M, De Carlo N, Oelbermann M</i>	156
Can agroforestry improve soil water and temperature dynamics in agriculture? A case study with syntropic farming in Bahia, Brazil	
<i>Damant G, Villela F</i>	161
Carbon storage in the soil under different land uses in the South of Portugal	
<i>Ferreiro-Domínguez N, Palma JHN, Paulo JA, Rigueiro-Rodríguez A, Mosquera-Losada MR</i>	165
Microclimate of a special shelterbelt system under arid site conditions in Hungary	
<i>Honfy V, Bakti B, Borovics A, Rásó J, Keserű Z</i>	169
Soil erosion risk and agroforestry implementation in Tuscany: locating best practices for vulnerability management with a GIS-based scenario approach	
<i>Mantino A, Volpi I, Dragoni, Cappucci A, Mele M, Bonari E, Pecchioni G, Anecchini F, Ragolini G</i>	173
Silvopastoral agroforestry – an option to support sustainable grassland intensification	
<i>McAdam JH, Olave R, Fornara D</i>	178
Comparison of observed data and high-resolution regional climate simulations for process based modelling	
<i>Palma JHN, Cardoso RM, Soares PMM, Oliveira TS, Tomé M</i>	181
Development of multi-use concepts to fight against climate change in the project MUNTER	
<i>Wagener F, Böhmer J, Seiler S, Thomas K, Plogmacher A</i>	186

Testimonies of farmers from Europe

Oral Presentations

Varkensbedrijf Neimeijer: experience in developing an agroforestry system for pigs	
<i>Neimeijer N, Neimeijer J, San Giorgi X, Dawson A, Kleijer G, Cremer H</i>	191
Integrating trees in farm incubators to improve sustainability and efficiency of production systems: a collaborative agroforestry project	
<i>Person S, Leblanc J, Aubertin C</i>	195
Oostwaard – multistrata agroforestry smallholding	
<i>San Giorgi X</i>	200

Silvopastoral agroforestry for rural environment sustainability and valorization of the region of Guarda and Serra da Estrela, Portugal	
<i>Simões MF, Tomás A, Paulo JA</i>	205

Poster Presentations

Janmiekeshoeve: an organic dairy farm in transition to a biodiverse agroforestry system	
<i>Heesakkers J</i>	209

Environmental benefits of agroforestry

Oral Presentations

Agroforestry, grass, biomass crop, and row-crop management effects on soil water dynamics for claypan landscapes	
<i>Alagele SM, Anderson SH, Udawatta RP, Jose S</i>	212
Inventory of tree hedgerows in an Italian agroforestry landscape by remote sensing and GIS-based methods	
<i>Chiocchini F, Ciolfi M, Sarti M, Lauteri M, Cherubini M, Leonardi L, Nahm M, Morhart C, Paris P</i>	217
How do agroforestry trees affect the supply of regulating ecosystem services?	
<i>Crous-Duran J, Graves AR, Garcia de Jalón S, Kay S, Paulo JA, Tomás M, Palma JHN</i>	222
The impact of soil and vegetation management of ecosystem services in European almond orchards	
<i>Leijster V, Santos MJ, Díaz M, Wassen MJ, Belen AB, Ramos ME, Verweij PA</i>	227
Agroforestry component in formation and functioning of current agricultural landscapes	
<i>Yukhnovskiy V, Gladun G, Lobchenko G, Khryk V</i>	232

Poster Presentations

Agroforestry system benefits to environment: carbon stock, biomass production between rows and soil attributes	
<i>Abdo MTVN, Siqueira CCZ, Chiba MK, Santos GXL, Rotta M, Rosa JM, Martins ALM, Pissarra TCT, Fabri EG, Chaves TH</i>	237
Hedgerows as form of agroforestry to sequester and store carbon in agricultural landscapes: a review	
<i>Blair J, Olave R, McAdam J</i>	242

Agroforestry systems as alternative for conserving native plant species and improving agro-ecological knowledge	
<i>Cadena González AL, Buttschardt T</i>	246
Impact of trees on soil nitrogen dynamics in temperate silvoarable agroforestry systems	
<i>Coussement T, Janssens P, Elsen A, Pardon P, Nelissen V, Reubens B, Vandendriessche H</i>	250
Time and crops influences on carabids taxonomic and functional diversities within a pesticide-free agroforestry cropping system	
<i>Lagier C, Garcia E, BenSarsa L, Vannieuwenhuysse A, Seyed-Esmail A, Oheix S, Simon L, Mercadal AM, Grandgirard D</i>	255
Exploring the relationships among bio-physical and socio-cultural ecosystem services of agroforestry systems across Europe	
<i>Roces-Diaz JV, Rolo V, Kay S, Moreno G, Szerencsits E, Fagerholm N, Plieninger T, Torralba M, Graves A, Giannitsopoulos M, Palma J, Herzog F</i>	260
A multi-factorial sustainability assessment of five European agroforestry farms	
<i>Smith LG, Smith J, Wolfe M, Ghaley BB, Pisanelli A, Russo G, Sandor M, Gliga A, Wawer R, Borek R</i>	265
Agroforestry practices for water quality and quantity benefits	
<i>Udawatta RP</i>	269
Combining of biomass production for energy with agroforestry – experience from short rotation coppice with poultry breeding	
<i>Weger J, Vávrová K, Bubeník J, Lojka B, Houška J, Kotrba R</i>	274

Biodiversity and added value

Oral Presentations

SCA0PEST pesticide-free agroforestry cropping system: effects on weed communities	
<i>François M, Seyed Esmail A, Garcia E, Faucon MP, Grandgirard D, Simon L, Salitot G</i>	279
Sowing legume-rich pastures make compatible an increase in production with the conservation of plant diversity of Mediterranean dehesas	
<i>Hernández-Esteban A, López-Díaz ML, Moreno G</i>	283

Specialty crop development for temperate agroforestry systems: sustainable managements, marketing and promotion for the Midwest region of the USA	
<i>Ormsby Mori G, Gold M, Jose S</i>	288
Gradients in abundance and diversity of ground-dwelling arthropods in the temperate silvoarable fields	
<i>Pardon P, Reheul D, Mertens J, Reubens B, De Frenne P, De Smedt P, Proesmans W, Van Vooren L, Verheyen K</i>	292
A cost-effectiveness analysis of temperate silvoarable systems: what contribution do ecosystem services make?	
<i>Staton T, Walters R, Smith J, Chesshire H, Girling R</i>	297

Poster Presentations

Exploring the nutritional value of feedstuffs in two food-forest case studies in The Netherlands	
<i>Hanegraaf MC, Van der Horst N, Oosterhof G</i>	302
Fast growing tree species in agroforestry systems: soil, tree growth and understory biodiversity	
<i>Rodríguez-Rigueiro FJ, Ferreiro-Domínguez N, Rigueiro-Rodríguez A, Mosquera-Losada MR</i>	306

Tree fodder: food for thoughts?

Oral Presentations

Nutritional potential of fodder trees: the importance of tree species, soil type and seasonal variation	
<i>Luske B, van Eekeren N</i>	310
Mineral composition of ash leaves (<i>Fraxinus excelsior</i> L.) used as fodder for the ruminants in summer	
<i>Mahieu S, Emile JC, Novak S</i>	314
Exploring an innovative approach to study browsing behavior of dairy cows and the performance of self-meditative behavior in relation browsing	
<i>Roelen SSM, Luske B, Wagenaar JP</i>	319
Tree fodder in UK livestock systems opportunities and barriers	
<i>Smith J, Westaway S, Whistance L</i>	324
Early results of the effects of two varying celtic pig stocking densities on iberico-atlantic oakwoods (A Coruña, Spain)	
<i>Silva-Pando FJ, Alonso Santos M, Bustos Vázquez M, Ignacio Quinteiro MF</i>	328

Poster Presentations

Feeding value of different plant functional types of oak Mediterranean ecosystems

Castro M, Fernández-Núñez E.....333

Innovations in agroforestry

Oral Presentations

Creating agroforestry innovation and best practice leaflets

*Burgess P, Moreno G, Pantera A, Kanzler M, Hermansen J, Van Lerberghe P,
Balaguer F, Girardin N, Rosati A, Graves A, Watté J, Mosquera-Losada R,
Waldie K, Pagella T, Liagre F.....336*

Lessons learnt from the intercropping and grazing of high value tree systems across Europe

*Pantera A, Mosquera-Losada MR, Burgess P, Graves A,
Ferreiro-Domínguez N, Corroyer N, McAdam J, Rosati A,
López-Díaz ML, Mantzanas K, Moreno G, Papadopoulos A,
Papanastasis VP, Van Lerberghe, Giannitsopoulos M.....342*

SidaTim: assessing the potential of new biomass crops and valuable timber trees in agroforestry systems

*Paris P, Augusti A, Burgess P, Bury M, Chiocchini F, Cumplido-Marin L,
Facciotto G, Chiarabaglio PM, Graves A, Lauteri M, Leonardi L, Martens R,
Morhart C, Rossi AE, Tarchi M, Nahm M.....346*

Using biochar from sewage sludge and other feedstocks in European agroforestry: opportunities and challenges

Nair VD, Freitas AM, Mosquera-Losada MR, Ferreiro-Domínguez N, Nair PKR.....351

AFINET: agroforestry innovation thematic network

*Villada A, Verdonckt P, Ferreiro-Domínguez N, Rodríguez-Rigueiro FJ,
Arias-Martínez D, Rois-Díaz M, den Herder M, Paris P, Pisanelli A,
Reubens B, Nelissen V, Paulo JA, Palma JHN, Vityi A, Szigeti N,
Borek R, Galczynska M, Balaguer F, Smith J, Westaway S,
Rigueiro-Rodríguez A, Mosquera-Losada MR.....355*

Poster Presentations

Combining ornamental tree and forage crop production using both field experiments and modelling approach in The Netherlands	
<i>Erdem F, Hoekstra N, Luske B, Crous-Duran J, Hautier Y, Van Eekeren N</i>	360
Breeding durum wheat for agroforestry: what to look for?	
<i>Gosme M, Panozzo A, Desclaux D</i>	363
Biomass production and concentration of rosmarinic acid in <i>Melissa officinalis</i> L. established under <i>Prunus avium</i> L.	
<i>Mosquera-Losada MR, Ferreiro-Domínguez N, Romero-Franco R, González-Hernández MP, Rigueiro-Rodríguez A</i>	369
Breeding for agroforestry: is it only breeding for shade?	
<i>Panozzo A, Desclaux D</i>	373
Agroforestry systems and innovation in extra-virgin olive oil chain in Central Italy	
<i>Pisanelli A, Consalvo C, Martini E, Lauteri M, Camilli F, Paris P</i>	378
Bio-mulch: an effective tool of weed suppression in alley cropping	
<i>Vityi A, Kiss Szigeti N, Marosvölgyi B, Schettler P</i>	383
Effects of shade on black currant physiology and productivity	
<i>Wolske E, Branham B, Wolz K</i>	387

Social and economic aspects in developing agroforestry

Oral Presentations

Growing a food forest as a sustainable business; some practical reflections on the basis of <i>Food Forest Eemvallei Zuid</i>	
<i>Buiter M, Van Eck W, De Waard FJ, Derksen E, en Lensink B</i>	391
Stakeholders' perceptions of the environmental and socio-economic benefits of agroforestry systems: an online survey in Italy	
<i>Camilli F, Marchi V, Pisanelli A, Seddaiu G, Paris P, Franca A, Rosati A</i>	396
Carbon footprint in dehesa agroforestry systems	
<i>Escribano M, Moreno G, Eldesouky A, Horrillo A, Gaspar P, Mesías FJ</i>	401
Effective managing, initiation and monitoring food forest	
<i>Fonk SG, Lenderink R, Sendar N</i>	406
Remains of chestnut wood pastures as part of agroforestry systems in Slovakia	
<i>Pástor M, Jankovič J, Pažitný J</i>	411

Poster Presentations

Differences within similarities: typology of farming strategies and natural resource management in two *ejidos* of Jalisco, Mexico

Monroy-Sais AS, García-Frapolli E, Mora-Ardila F, Skutsch M, Gerritsen PRW, Casas A, Cohen D, Ugartechea-Salmerón O.....415

Agroforestry in the Nijmegen-area; visioning, sharing, designing

Van der Meulen SJ.....420

Tree-Crop-Animal competition and facilitation

Oral Presentations

Combining short rotation willow coppice with free range chickens – experiences from experiments on farm level in The Netherlands

Boosten M, Penninkhof J.....424

Impact of tree root pruning on yield of durum wheat and barley in a Mediterranean alley cropping system

Inurreta-Aguirre HD, Lauri PÉ, Dupraz C, Gosme M.....428

Modelling shadow in agroforestry systems based on 3D data

Morhart C, Roskopf E, Nahm M.....433

Horticultural agroforestry systems: a modelling framework to combine diversification and association effects

Paut R, Sabatier R, Tchamitchian M.....437

Improving crop productivity in agroforestry systems: low leaf respiration is a key trait

Rosati A, Pang K, Van Sambeek J, Gold M, Jose S.....442

Poster Presentations

Less avian influenza risk birds in poultry free range areas covered with trees

Bestman M, Wagenaar J, de Jong W, Weerts T, Luske B.....447

Polycultures in agroforestry

Groeneweg D, Vishedijk F, Appelman J, van Buiten G, San Giorgi X, Hautier Y.....452

Improve the efficiency of afforestation by the use of alley cropping system

Kovács K, Vityi A.....457

Grassland management effects on above-ground matter fluxes in silvopastoral agroforestry systems

Malec S, Graß R, Wachendorf M.....462

Does tree density or fertilisation in silvopastoral systems affect tree or pasture production?	
<i>Mosquera-Losada MR, Arias-Martínez D, Rigueiro-Rodríguez A, Ferreiro-Domínguez N</i>	466
Temperate agroforestry: yield of five key arable crops near tree rows of <i>Populus x canadensis</i>	
<i>Pardon P, Reubens B, Mertens J, Verheyen K, De Frenne P, Van Waes C, Reheul D</i>	471
Mediterranean silvoarable systems for feed and fuel: the Agroforces project (agroforestry for carbon sequestration and ecosystem services)	
<i>Pecchioni G, Mantino A, Bosco S, Volpi I, Giannini V, Dragoni F, Tozzini C, Coli A, Mele M, Ragaglini G</i>	476
Interactions between trees, crops and animals: experiences in a novel bioenergy-livestock system in the UK	
<i>Smith J, Deremetz V, Gerrard C, Costanzo A</i>	479
Comparing long-term crop yields of a short rotation alley cropping agroforestry system and of a standard agricultural field in Northern Germany	
<i>Swieter A, Langhof M, Lamerre J, Greef JM</i>	484
Simulation of annual leaf carbon fluxes and analysis of stands structure of poplars and black locus in an alley-cropping system, Brandenburg, Germany	
<i>Veste M, Malaga Linares RA, Seserman DM, Freese D, Schmitt D, Wachendorf M, Küppers M</i>	488

Agroforestry and multiple products value chain

Oral Presentations

Impact of pollarding on growth and development of adult agroforestry walnut trees	
<i>Dufour L, Gosme M, Le Bec J, Dupraz C</i>	493
Food value, the online marketplace that really makes local food chains take off!	
<i>Karssen M, Koster S, Dolmans L, Wentink H, van Dooren N</i>	497
Durum wheat in olive orchard: more income for the farmers?	
<i>Panozzo A, Desclaux D</i>	501
Agroforestry for food in the U.S. corn belt : key aspects of tree crop improvement to enable novel systems	
<i>Revord RS, Lovell ST, Mattia C, Molnar TJ, Wolz KJ</i>	506

The emerging practice of food forest – a promise for a sustainable urban food system?	
<i>Van Dooren N, Oosterhof G, Stobbelaar D, Van Dorp D</i>	510

Poster Presentations

Opportunities for agroforestry in Finland	
<i>den Herder M, Vanhanen H, Karvinen P, Matila A, Mattila I, Nuutinen S,</i> <i>Ryhänen S, Siikavirta K, Westersträhle M, Verdonckt P, Muñoz Alonso A</i>	514
A qualitative study to develop an “agroforestry” brand: the case of the Spanish dehesas	
<i>Escribano M, Gaspar P, Maestre LM, Elghannam A, Mesías FJ</i>	518
Hybrid aspen and perennial grass agroforestry system interactions	
<i>Lazdina D, Rancane S, Makovskis K, Sarkanabols T, Dumins K</i>	523
The biomass potential on existing linear woody-features in the agricultural landscape	
<i>Tsonkova P, Böhm C, Hübner R</i>	527

Education and tools to investigate agroforestry

Oral Presentations

Identifying bottlenecks and gateways for agroforestry development in Poland	
<i>Borek R, Gałczyńska M</i>	532
Education on agroforestry in the context of sustainable development	
<i>Hübner-Rosenau D, Koch O, Hofmann P, Große, F, Bloch R, Cremer T</i>	537
Experiences with stakeholder specific formats participation to foster agroforestry	
<i>Hübner R, Pukall K, Zehlius-Eckert W</i>	542
Strategies for stimulating the transition into agroforestry in Quebec, Canada	
<i>Olivier A, Anel B, Cogliastro A, Rivest D</i>	546
Education in agroforestry: preliminary results from the AGROF MM – Erasmus + project	
<i>Pantera A, Burriel C, Herdon M, Tamás J, Lamaison M, Musquar C,</i> <i>Seeman M, Atanassova S, Harfouche A, Escural JM, Fico F, Devernay S,</i> <i>Lavoyer S, Balaguer F, Papadopoulos A, Papanastasis V, Mantzanas K</i>	549

Poster Presentations

How to make agroforestry systems pay off? Using its values to create economic development pathways

Borremans L, Reubens B, Wauters E.....553

Introducing modern agroforestry to students as the next generation of decision makers in ecosystem management

Lamersdorf N, Corre M, Gernandt P, Isselstein J.....558

Modelling agroforestry systems with web-EcoYield-SAFE

Palma JHN, Tomás A.....563

FEEDING VALUE OF DIFFERENT PLANT FUNCTIONAL TYPES OF OAK MEDITERRANEAN ECOSYSTEMS

Castro M¹, Fernández-Núñez E²

(1) Mountain Research Centre (CIMO), Polytechnic Institut of Bragança, Campus de Santa Apolónia, 5300- 253. Bragança, Portugal (2) Escuela Politécnica Superior. Campus Terra. Universidad de Santiago de Compostela, 27002 - Lugo, Spain

*Corresponding author: marina.castro@ipb.pt

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).

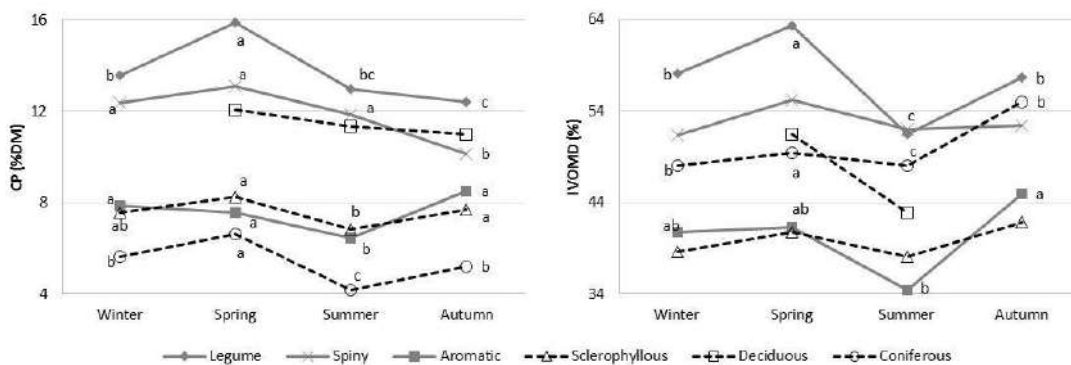


Figure 1: Crude protein content (CP) and In vitro organic matter digestibility (IVOMD) in different functional groups of trees (deciduous, sclerophyllous and coniferous) and shrubs (legume, spiny, and aromatic). Different letters indicate significant differences between seasons in the same functional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