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Evaluation of grasslands in the Rural Park of Anaga (Tenerife, Canary Islands)

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SUMMARY – The Canary Islands have a total surface area of 752,905 ha, 40% of which are protected areas. The study was carried out in Tenerife at the Rural Park of Anaga where sheep and goats graze in semi-extensive farms. The aim of this study was to carry out research into the botanical composition, relative frequency and quality of the grasslands at the Rural Park. A total of 79 pasture samples were analysed for dry matter content (DM), organic matter content (OM), neutral detergent fibre (NDF), acid detergent fibre (ADF) and *in vitro* organic matter digestibility (IVOMD). The results varied from 86.05 to 92.53% DM, from 77.07 to 83.9% OM (on DM basis), from 41.76 to 65.92% NDF, from 24.54 to 30.05% ADF and from 27.98 to 42.07% IVOMD.

Key words: Grasslands evaluation, botanical composition, semiarid pastures, evaluation of grasslands, nutritive value.

RESUME – *"Evaluation des parcours du Parc rural d'Anaga (Tenerife, Iles Canaries)". Les îles Canaries ont une superficie totale de 752 905 ha, dont 40% sont protégés. L'étude fut effectuée à Tenerife au Parc rural d'Anaga où moutons et chèvres paissent sur des exploitations semi-extensives. Le but de cette étude était l'évaluation de la nature, la fréquence et la qualité des pâtures dans le parc rural. Un total de 79 échantillons de pâture furent analysés pour leur contenu en produits secs (DM), matière organique (OM), parois totales (NDF), lignocellulose (ADF) et digestibilité* in vitro *des matières organiques (IVOMD). Les résultats varient de 86,05 à 92,53% DM, de 77,07 à 83,9% OM, de 41,76 à 65,92% NDF, de 24,54 à 30,05% ADF et de 27,98 à 42,07% IVOMD.*

Mots-clés : *Evaluation des parcours, composition botanique, parcours semi-arides, herbacées, valeur nutritive.*

Introduction

The Rural Park of Anaga is located in the northeast area of Tenerife Island, with a total surface area of 14,224 ha. This Park is a protected area where the main objective is to combine the preservation of natural resources with the development of economic activities such as agriculture, stock farming and tourism (Gobierno de Canarias, 1994). The Rural Park is located in a mountainous region with the characteristics of less favoured zones. The Park has several steep hillsides, altitudes of up to 1000 m above sea level and deep gorges, which give to the area wide ecosystem diversity. A total of 44 goat farms are located in the Park and almost 91% of the farms use pastures as a feed resource (Bermejo *et al.*, 2000). The aim of this study was to know the quality, nutritive value and the botanical composition of the grassland used by the animals.

Material and methods

The study was conducted in the Rural Park of Anaga, in Tenerife province (Canary Islands). Rainfall occurs from October to March (mean temperature: 16.7°C) and from April to September (mean temperature: 22.9°C) are dry seasons. Mean rainfalls are 556 mm/year in north agro-ecological units (AU) and 293 mm/year in south AU. Seven AU were defined according to main vegetation, geography-morphology characteristics and orientation of the areas. A total of 79 herbage samples (32 random cuts) from seven AU were collected in the spring and summer seasons of 1999 (at the beginning of April and at the end of August). The seven AU and the total number of samples analysed in each unit are described in Table 1. The botanical composition and relative frequency (%)

of the different plants species in the seven AU were determined by the point quadrate method (Daget and Poissonet, 1971). Herbage samples were dried at 60°C in a forced air oven and separated into leguminous, gramineous and other plants. Then, the samples were ground to pass a 1 mm screen.

Dry matter (DM) and ash content were analysed in accordance with the methods of the Association of Official Analytical Chemists (1990). Neutral detergent fibre (NDF) and acid detergent fibre (ADF) were analysed according to van Soest *et al*. (1991). *In vitro* organic matter digestibility (IVOMD) of duplicate samples was determined according to Tilley and Terry (1963). The nutritive value data were analysed for variance and correlation analysis using the SPSS program and significant differences were compared by Duncan test at the 0.05 level.

Results and discussion

The percentage of gramineous, legumes and other species in the seven AU are shown in Table 1.

Table 1. Description of the seven agro-ecological units (AU) studied

AU	N†	Gramineae (%)	Leguminoseae (%)	Other (%)
1. Valleys with formations of transition looking north	17	47.0	23.5	29.4
2. Hillside with formations of transition looking north	14	21.4	35.7	42.8
3. Valleys with Euphorbiaceae Family looking south	9	66.6	22.2	11.1
4. Valleys with Euphorbiaceae Family looking north	19	36.8	26.3	36.8
5. Hillside with Euphorbiaceae Family looking south	4	50.0	–	50.0
6. Hillside with Euphorbiaceae Family looking north	4			50.0
7. Grassland in abandoned cultivated areas	12	66.6	–	33.3

†N: Total number of samples analysed in each agro-ecological units.

The botanical composition and relative frequency (%) of the different plant species in the seven AU are given in Table 2. The highest relative frequency found was *Asphaltium bituminosum* (28.6%) and *Trachynia distachya* (9.5%) in AU 1; *Artemisia thuscula* (17.9%), *Asphaltium bituminosum* (10.7%) and *Asphodelus aestivus* (10.7%) in AU 2; *Hyparrhenia hirta* (13.6%), *Lavandula canariensis* (11.4%) and *Cenchrus cilaris* (11.4%) in AU 3; *Erica arborea* (24.2%) and *Teline canariensis* (21.2%) in AU 4; *Euphorbia canariensis* (27.6%), *Aeonium* sp. (17.2%) and *Artemisia thuscula* (10.3%) in AU 5; *Artemisia thuscula* (14.8%), *Urginea maritima* (11.1%), *Aeonium* sp. (11.1%) and *Agyranthemum frutescens* (11.1%) in AU 6; and *Periploca laevigata* (10.7%) in AU 7. The mean botanical composition of the different AU analysed was 41.0% of gramineous, 18.3% of leguminous and 40.7% of other plants.

Mean results of analyses of DM, organic matter (OM), IVOMD, NDF and ADF contents (on DM basis) of pasture samples in the different AU are given in Table 3. The results varied from 86.1 to 92.5% DM, from 77.1 to 84.0% OM, from 41.8 to 65.9% NDF, from 24.5 to 30.1% ADF and from 28.0 to 42.1% IVOMD. There were significance differences ($P < 0.05$) in the chemical composition and IVOMD between pasture samples of the different AU (Table 3).

Significant correlation coefficients were found between NDF content and IVOMD (–0.712, $P < 0.01$) and between ADF content and IVOMD (–0.704, $P < 0.01$). The NDF and ADF contents of pasture samples were very similar to those found by Vázquez de Aldana *et al.* (1998) in semiarid grassland in western Spain. IVOMD results are lower than those found by Olea and Paredes (1997) in grassland in southwest Spain.

Mean results of analyses of DM, OM, IVOMD, NDF and ADF contents (on DM basis) of gramineae, leguminosae and other samples in the different AU are given in Table 4. As we expected there were significant differences ($P < 0.05$) between gramineae and leguminosae in IVOMD, NDF and ADF content, with higher IVOMD values and lower NDF and ADF values in leguminosae compared to gramineae.

Table 2. Botanical composition and relative frequency (%) of the different species in the seven agro-ecological units (AU)

Species	AU						
	1	2	3	4	5	6	7
Aeonium canariensis				3.0			
Aeonium sp.	2.4	1.8	2.3		17.2	11.1	
Anagallis arvensis			2.3	3.0			3.6
Argyranthemum frutescens					3.4	11.1	
Artemisia thuscula	7.1	17.9			10.3	14.8	5.4
Asphaltium bituminosum	28.6	10.7		9.1	6.9		
Asphodelus aestivus		10.7		3.0	6.9	7.4	
Avena sp.	2.4						
Bromus hordaceus	2.4						7.1
Calendula arvensis	4.8						
Carduus clavulatus		1.8					
Cenchrus cilaris			11.4				
Dactylis amithi		5.4					
Drusa glandulosa		3.6					
Echium plantagineum	4.8	3.6	2.3	9.1			5.4
Erica arborea	2.4			24.2			
Euphorbia canariensis					27.6		
Euphorbia obtusifolia			9.1		3.4	3.7	3.6
Ferula sp.						3.7	
Fumaria sp.						3.7	
Galactites tomentosa	7.1	3.6				3.7	7.1
Geranium sp.							3.6
Hyparrhenia hirta	4.8		13.6	3.0			1.8
Hypericum canariensis				3.0			1.8
Jasminum odoratissimum							5.4
Kleinia neriifolia			2.3			3.7	
Lathirus sp.				3.0			
Lavandula buchii			2.3		6.9		
Lavandula canariensis	4.8		11.4				
Linaria arvensis					3.4		
Lobularia canariensis		1.8					
Medicago sp.		8.9	6.8		3.4		5.4
Micromeria varia		1.8		9.1			
Opuntia maxima				3.0			
Pericallis tussilaginis		3.6					
Periploca laevigata			9.1			3.7	10.7
Phagnalon saxalite				3.0			
Plantago sp.	4.8	1.8	2.3				
Polycarpon tetraphyllum						3.7	
Rubia fruticosa					3.4		
Rubus inermis	4.8						
Rumex sp.		1.8				7.4	
Sherardia arvensis					3.4		5.4
Scorpirus sp.	1.8	1.8	2.3		3.4		8.9
Silene gallica		1.8			3.4		
Stachys arvensis		1.8				3.7	
Teline canariensis	4.8	1.8		21.2			
Torilis sp.	4.8	3.6					7.1
Trachynia distachya	9.5	1.8					
Trifolium sp.		9.0	2.3	6.0		7.4	
Urginea maritima					3.4	11.1	

Table 3. Mean results of analyses of DM, OM, IVOMD, NDF and ADF contents (on DM basis) of pasture samples in each agro-ecological unit (AU)

AU	DM (%)	OM (%)	IVOMD (%)	NDF (%)	ADF (%)
1	91.45^{ab}	83.32^{a}	35.21^{ab}	55.30^{b}	27.59^{a}
2	90.57^{b}	82.80^{a}	37.59^{a}	50.70^{bc}	25.46^{b}
3	92.53^{a}	83.97^{a}	28.44^{b}	65.92^{a}	30.05^{a}
4	91.00^{b}	83.50^{a}	39.41^{a}	52.27^{b}	28.82^{a}
5	87.88^{c}	79.88^{b}	27.98^{b}	45.89^{cd}	25.67^{b}
6	86.05^{d}	77.07^{c}	42.07^{a}	41.76^{d}	27.13^{ab}
7	91.29^{ab}	82.52^{a}	35.77^{ab}	55.71^{b}	24.54^{b}

^{a,b,c,d}Values in the same column with different superscripts are significantly different at $P < 0.05$.

Table 4. Mean results of analyses of DM, OM, IVOMD, NDF and ADF contents (on DM basis) of gramineae, leguminosae and other samples in the different agro-ecological units (AU)

Species	DM (%)	OM (%)	IVOMD (%)	NDF (%)	ADF (%)
Gramineae	92.16^{a}	83.87^{a}	30.34^{b}	67.62^{a}	31.75^{a}
Leguminosae	90.84^{ab}	83.98^{a}	48.68^{a}	42.35^{b}	21.13^{b}
Other	89.79^{b}	81.27^{b}	40.49^{ab}	44.17^{b}	24.74^{b}

^{a,b}Values in the same column with different superscripts are significantly different at $P < 0.05$.

Conclusions

Nutritive value of grasslands in the Rural Park of Anaga is slightly low compared to the nutritive value of natural grassland in southwest Spain, mainly due to environmental harshness and climatic variation in the last years. Nevertheless, in Canary Islands, the forage production is expensive and scarce, so any supply of local resources (mainly pastures) to the goats will reduce the final production cost at the farm's level. It has been found a high diversity of plant species in the AU, some of them being endemic plants from Canary Islands. The most significant ones were: *Asphaltium bituminosum, Erica arborea, Euphorbia canariensis* and *Teline canariensis*.

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