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Levels of bioelements and their relation to the ruminants' needs in the most important pasture-plant species of the wooded dehesa (grazing-land) in the south-west of Spain

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SUMMARY - The *Trifolium subterraneum* and *Orithopus compressus* species, together with the gramineae group are considered the most important pasture plants (pratenses) of the wooded 'dehesa' of Extremadura. In the present paper 5 representative "dehesas" (pasture lands) of the south-west of the province of Badajoz (200,000 ha) are studied over a period of two agricultural years (1993-94 and 94-95). Soils and plants were analysed every fortnight approximately, from Autumn until the end of Spring. Samples of plants from the different plots were taken to check the proportions of N, P, K, Ca and Mg. Climatologically two different weather conditions were studied, a year of almost average rainfall and another of extreme drought. The minimum values for these 5 elements were revised. The Nitrogen proportion in both leguminous species was above the required minimum level (even in dry grass), for the ruminant feeding (over 1.5% and up to 3.5% in January and February), whereas there was a deficiency of Nitrogen in the gramineae group from April on. Regarding Phosphorus, as the plant becomes mature a decrease is noted, which was stressed in the final months of the cycle; all the dehesas studied except Manpolín reached lower rates than the minimum required (0.20%). The potassium evolved in a similar way to that of P, although deficiencies (minimum 0.60%) arose only in Campos de Oliva. Its behaviour was similar in both years. Calcium had a similar behaviour in all the dehesas studied along the vegetative cycle. It was always above the minimum level (0.30%) in the leguminous plants, whereas deficiencies arose in the gramineae from April on in both years. Magnesium results were similar to those of Calcium.

Key words: Mediterranean pasture, grass quality, annual pasture plants, dehesa.

RESUME - "Teneur en bioéléments en fonction des besoins des ruminants chez les espèces pastorales les plus importantes de la dehesa boisée du Sud-Ouest de l'Espagne". Les espèces *Trifolium subterraneum* et *Orithopus compressus*, avec le groupe des graminées sont considérées les plantes de pâturage les plus importantes de la "dehesa" boisée d'Extremadura. Dans cet article on étudie 5 "dehesas" (pâturages) représentatives du sud-ouest de la province de Badajoz (200.000 ha) sur une période de deux années agricoles (1993-94 et 94-95). On a analysé les sols et les plantes tous les quinze jours environ de l'automne jusqu'à la fin du printemps. On a pris des échantillons de plantes des différentes parcelles pour vérifier les proportions de N, P, K, Ca et Mg. On a étudié deux conditions climatiques différentes, une année à pluviométrie presque moyenne et un autre à sécheresse extrême. On a révisé les valeurs minimales pour ces 5 éléments. La proportion d'azote chez les deux espèces de légumineuses était au-dessus du niveau minimum exigé (même chez les graminées sèches), pour l'alimentation des ruminants (plus de 1,5% et jusqu'à 3,5% en janvier et février), alors qu'il y avait un manque d'azote dans le groupe des graminées à partir d'avril. En ce qui concerne le phosphore, à mesure que la plante mûrissait on observe une baisse qui l'accentuait dans les derniers mois du cycle ; toutes les dehesas étudiées sauf Manpolín ont présenté des taux inférieurs au minimum exigé (0,20%). Le potassium a évolué d'une façon semblable à celle du P, bien que des déficits (minimum 0,60%) n'aient été observés que dans Campos de Oliva seulement. Son comportement était semblable pendant les deux années. Le calcium avait un comportement semblable dans toutes les dehesas étudiées tout au long du cycle végétatif. Il était toujours supérieur au niveau minimum (0,30%) chez les légumineuses, alors que des déficits sont survenus chez les graminées à partir d'avril pendant les deux années. Les résultats du magnésium étaient semblables à ceux du Calcium.

Mots-clés : Pâturage méditerranéen, qualité de l'herbe, plantes annuelles de pâturage, dehesa.

Introduction

Pastures are the main fundamental and unavoidable elements of the Dehesa; their flowers are very varied, being rich in annual herbaceous species. The constituents of the herbaceous species of gramineous and leguminous plants were analysed using chemical methods. The sampling of all species was done at the same time (*Poa bulbosa*, *Bromus ssp*, *Lolium temulentum*, *Poa annua*, *Dactylis glomerata*, *Lolium rigidum*, *Hordeum murinum*, *Stipa ssp*, *Vulpia ssp*, etc.). *T. Subterraneum* and *O. Compressus* belonging to the leguminous family were sampled and analysed separately, since they are the most representative species of dehesa. We studied the mineral content of N, P, K, Ca and Mg and their relationship with the needs of the ruminants that graze grasses and legumes (*T. Subterraneum* and *O. Compressus*) in the wooded dehesas of the south west of Spain (Viguera, 1996).

Material and methods

Location

The study was carried out in the following dehesas: Manpolín, La Crespa, Martín Vaca, La Cabra and Campos de Oliva, belonging to the municipalities of Olivenza, Jerez de los Caballeros, Alconchel, Villanueva del Fresno y Oliva de la Frontera. They were chosen due to their representative parameters (rainfall, winter temperature, texture, pH, and soil and flora nutrients).

The project lasted two years, 1993/94 under almost average weather conditions and 94/95 under a severe drought.

Method

The soil and plant nutrients were analysed (Duque Macías, 1970), the former once a year and the latter every 30 days from their nascency in Autumn to their withering at the end of Spring (Olea *et al.*, 1989). The average values shown in Table 1 are taken as the minimum bioelement levels in ruminant grazing.

Table 1. Ruminant needs of mineral elements (minimum figures)

Elements	ARC* (1968)	Bergner (1970)	Gueguen (1972)
Nitrogen	1.50%	-	-
Phosphorus	0.26%	0.20%	0.30%
Potassium	-	0.4-0.8%	-
Calcium	0.34%	0.30%	0.40%
Magnesium	0.07%	0.1-0.3%	0.15%

*Agricultural Research Council

Results and discussion

Soil

The soils have a light to medium texture, acid PH ranging from 4.9 (La Crespa) to 5.9 (Martín Vaca). There is low organic content and very low P content in all the dehesas studied but Manpolín. The potassium values go from low to medium, the lowest corresponding to Oliva de la Frontera. The Ca and Mg content is low in Manpolín and Martín Vaca and very low in the other dehesas. The concentration of Na is very low in all of them.

Weather

The two years studied had different annual rainfall. The first year (1993/94) the total rainfall was around 80% of the normal rate. Thus it may be considered average. But the second year of the project (1994/95) the rainfall was hardly 50% of the normal rate with the only exception of La Cabra where it was 73%. Therefore, the drought was serious. As for winter temperatures, both years may be considered average.

Minerals in the plants

The concentration of the minerals studied is shown in Figs 1a and b.

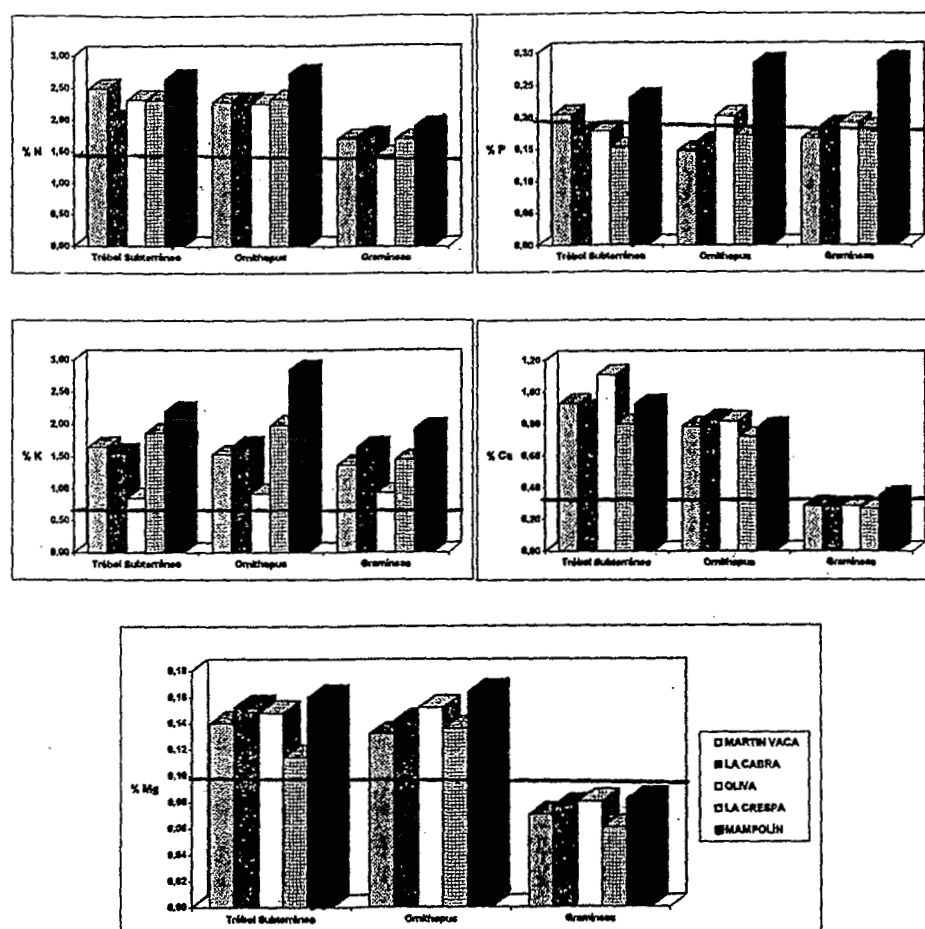


Fig 1a. Comparison of average content of bioelements in leguminous and gramineae plants in the 5 dehesas 1993/94.

Evaluation of the mineral composition

Nitrogen

The N concentration decreased as the plant grew in grasses and legumes in both years. The N proportion, in general, was lower in grasses than in legumes without any remarkable differences between them. If we consider 1.5% N (ARC, 1968) as the lowest suitable concentration for grazing ruminants, this level was always higher in both legumes (Montalvo *et al.*, 1984) compensating the lack of N in other

species. The grasses showed a deficiency of N from April on in all dehesas studied. The behaviour of N was similar in both years.

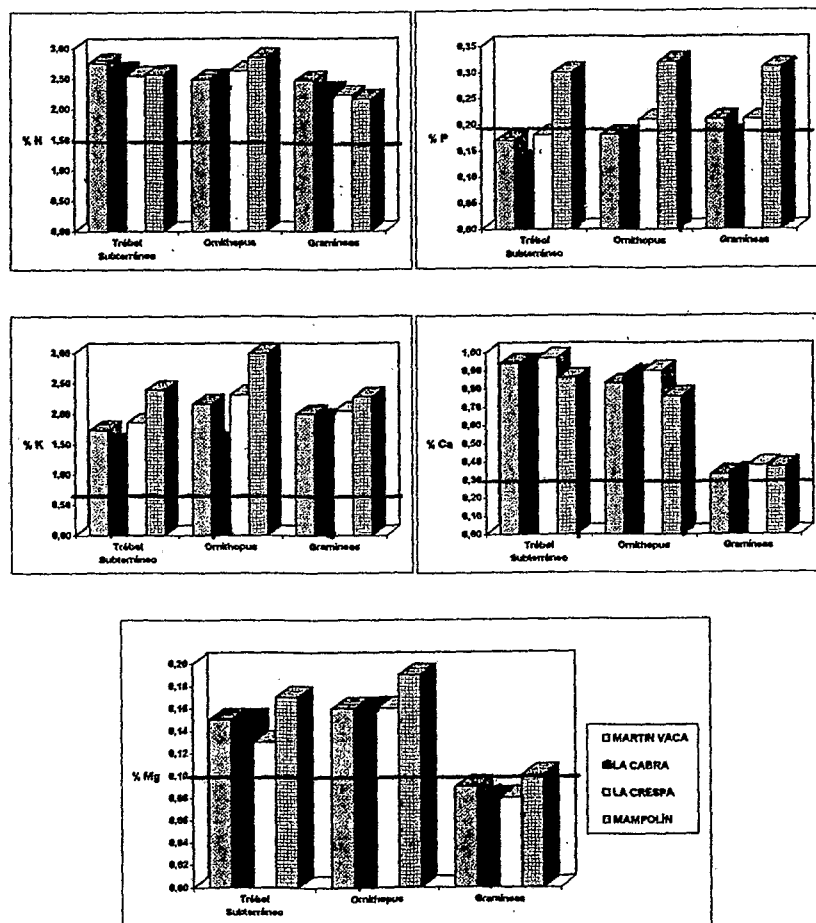


Fig 1b. Comparison of average content of bioelements in leguminous and gramineae plants in the 4 dehesas 1994/95.

Phosphorous

In the average year (1993/94) there was a deficiency of P from March on in the 3 species in all dehesas except Manpolín (14.3 ppm of P in the soil).

During the dry year (94/95) this deficiency <0.20% took place during the reproductive period, except in Manpolín.

Potassium

The concentration of potassium decreased along the vegetative cycle. There was no deficiency in any of the years, with the only exception of extremely poor grass in Campos de Oliva.

Calcium

There is a decrease of Ca in the 3 species as the plants grew. It was very similar in all dehesas. In the T. Subterraneum species this reduction was low in both years, perhaps due to the effect of seeds and

fruits (Olea *et al.*, 1989). There was no lack of Ca (Bergner, 1970) in the leguminous plants, however the gramineous plants presented deficiencies from April on.

Magnesium

There was a reduction in Mg over the whole vegetative cycle of the 3 species in both years, this decrease was very similar in all dehesas.

Only grasses showed deficiencies (Bergner, 1970) from March on in both years.

Conclusions

Grazing ruminants of dehesas did not present problems of deficiency of the elements studied, with the exception of phosphorous, or under conditions of extreme drought.

The content of phosphorous in plants was very much related to its presence in the soil and it can be stated the need of 12 to 14 ppm Olsen of P for this deficiency to disappear.

In years of severe drought this behaviour did not change substantially, although spring came earlier.

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