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in

Porqueddu C. (ed.), Ríos S. (ed.).
The contributions of grasslands to the conservation of Mediterranean biodiversity

Zaragoza : CIHEAM / CIBIO / FAO / SEEP
Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 92

2010
pages i-iv

Dry matter yield and quality evaluation at different growth stages of triticale forage in south-west of the Iberian Peninsula

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Abstract. The *dehesa* ecosystem in the south west of the Iberian Peninsula has in herbaceous biomass production, the basis of the extensive livestock management. Nevertheless, due to the erratic climatic conditions that the experiment areas endure, food shortage for the animals takes place in the course of the year. In this paper the possibility to introduce triticale crop for a double use (by grazing in winter and cut at early and late spring) has been studied. Triticale varieties were, var. Fronteira, var. Alter and two experimental cultivars from the Portuguese National Agricultural Research Institute, called INIA 1 and INIA 2. As reference treatment, a variety of Italian ryegrass, was used. The experiment was carried out in two different locations of the South-West of the Iberian Peninsula: in Elvas (Portugal) and in Jerez de los Caballeros (Spain), which have different rainfall and temperature ranges. As expected, every triticale cultivar biomass yield exceeded the reference treatment one. Fronteira variety, even though it did not have the best forage yield, it had a good one; that is important because this triticale variety was the best one as far as forage quality is concerned, measured by CP, OMD and NDF.

Keywords. Extensive pastures – Livestock – Dehesa – Silvopastoral.

Rendement en matière sèche et évaluation de la qualité à différents stades de croissance du fourrage de triticale dans le sud-ouest de la Péninsule Ibérique

Résumé. *La base de la gestion de l'élevage extensif dans l'écosystème de la* dehesa*, au sud ouest de la Péninsule Ibérique est la production de biomasse herbacée. Néanmoins, à cause des conditions climatiques erratiques que ces zones subissent, il s'expérimente un déficit de nourriture pour les animaux au long de l'année. Dans ce document, la possibilité d'introduire la culture de triticale à double utilisation (pâturage hivernale et coupe a la moitié et à la fin de la saison pour conserver le fourrage) est étudiée. Les cultivars de triticale ont été : var. Fronteira, var. Alter et deux cultivars en expérimentation de l'Institut de Recherche National de Portugal, appelés INIA 1 et INIA 2. Comme culture témoin on a utilisé le ray-grass italien. L'expérience a été menée sur deux endroits différents du sud ouest de la Péninsule Ibérique : Elvas (Portugal) et Jerez de los Caballeros (Espagne), ayant des différents ranges de température et de précipitation. Comme prévu, tous les rendements des cultivars de triticale dépassaient le rendement du témoin. Le rendement fourrager de la variété Fronteira, n'étant pas le meilleur, a été acceptable ; ceci est important parce que cette variété avait la meilleur qualité du fourrage mesurée par rapport au contenu en protéine brute et en fibre neutre détergent et à la digestibilité de la matière organique.*

Mots-clés. *Pâturages extensives – Élevage – Dehesa – Sylvopastoral.*

I – Introduction

The *dehesa* ecosystem stretches in the south west of the Iberian Peninsula about 4 millions hectares, most of which are in Extremadura and in the south central Portugal (MAPA, 2007). Although herbaceous pastures are considered the basis of the *dehesa* livestock feed, the erratic climate and the typical soils in these areas, make limited the productive potential (Olea *et al.*, 1987). All this demands the introduction of forage crops to meet livestock food requirements in winter and summer (Pinheiro *et al.*, 2009) to use the biomass, either by grazing or by cutting and preserving. The most interesting forage crops for Royo *et al*. (1994) and Caballero *et al*. (1995) are oat and triticale

crops. Moreover, the annual Italian rye-grass offers an important biomass quantity, due to the possibility of cutting it several times along its cycle. Despite this, none of these species are well known regarding their dual use; grazed in winter and cut and conserved at the middle and at the end of the spring. Triticale cultivars for this purpose are studied in this paper.

II – Material and methods

The experiment was carried out in the 2008-09 agricultural season, in two different *dehesas* of the south west of the Iberian Peninsula, with Mediterranean semiarid climate (Table 1).

Table 1. Temperature and rainfall of the two experiment locations in 2008-2009 agricultural season

Environment	Elvas	Jerez de los Caballeros
Temperature	16.8	16.1
Total rainfall	443.4	577.4
Rainfall winter (D-J-F)	116.3	323.6
Rainfall spring (M-A-M)	77.0	88.3

Each elemental plot had 18 m^2 (3 m x 6 m) and 4 replications, with acid soils (6.2 in Elvas and 5.4 in Jerez) and low organic matter in Elvas (1.34%) and middle in Jerez (2.4%). The 4 triticale varieties were; Fronteira, Alter and 2 varieties still in study by the Portuguese National Agricultural Research Institute which were called INIA 1 and INIA 2. The *Lolium multiflorum* westerworld type variety was Tetrawest.

Dry matter yield (DM), crude protein (CP), neuter detergent fibre (NDF) and organic matter digestibility (OMD) were determined on the collected samples following the official methods. Dates and places are exposed on Fig. 1.

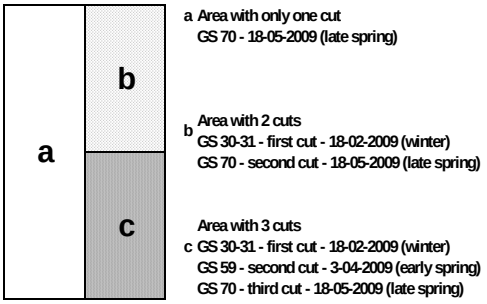

Fig. 1. Dates, growing stages and place of cut sketch in each elemental plot in the experiment locations.

Data results from the samples were subjected to variance analysis to determine the different treatment effect on the forage parameters, using Fisher test of least significant difference (LSD) at $P \leq 0.05$, for the treatment averages.

III – Results

Dry matter yield was studied adding winter production to late spring and/or early spring, to know the final yield of several cuts.

Table 2 shows that every triticale cultivar exceeded rye-grass yield, having more biomass quantity in Jerez de los Caballeros than in Elvas (6.0 facing 5.0 MT ha^{-1} of average dry matter yield).

Table 2. Dry matter yield (MT ha^{-1}) value applying different number of cuts in triticale and rye-grass crops in two different places in the Iberian Peninsula

Cultivar	Dry matter yield (MT ha^{-1})						Mean
	Elvas			Jerez de los Caballeros			
	1 cut	2 cuts	3 cuts	1 cut	2 cuts	3 cuts	
Fronteira	12.1	12.1	6.7	12.2	10.8	6.8	5.8a
Alter	13.5	9.7	7.8	13.0	7.4	4.8	5.5a
INIA 1	11.8	11.6	6.4	18.7	12.4	6.8	6.3a
INIA 2	10.3	10.5	7.6	16.8	14.6	10.3	6.4a
Rye-grass	4.5	5.4	5.9	8.4	7.7	5.7	3.5b

a,b: Data with different letters are significantly different with P < 0.001.

CP, OMD and NDF were studied making several cuts along its growing cycle (winter, early and late spring) or only one cut at the end of the season. Thus, Table 3 shows that applying only one cut at the end of the season, there is no significant differences between treatments regarding CP and NDF, appearing these differences when 2 or 3 cuts were applied along the cycle. With reference to CP, Fronteira did not have significant differences between reference treatment but with the rest of triticales, having a forage with almost 16% of CP. NDF values did not show differences between triticales but with rye-grass, which had a low quantity.

Table 3. Chemical composition of four triticale varieties and *Lolium multiflorum*, cut in two different regimes: one cut at the end of the season and several cuts along the growing cycle (mean)

Cultivar	CP (%)		NDF (%)		OMD (%)	
	1 cut	Mean several cuts	1 cut	Mean several cuts	1 cut	Mean several cuts
Fronteira	10.5	15.9a	50.3	47.3a	53.2b	65.7b
Alter	9.1	14.7b	47.5	47.4a	53.9b	61.8c
INIA 1	8.8	15.0b	49.8	48.8a	51.6b	62.4c
INIA 2	9.0	14.3b	48.5	47.6a	53.9b	62.3c
Rye-grass	10.2	16.4a	51.5	44.6b	61.9a	71.0a
	ns	P < 0.001	ns	P < 0.01	P < 0.001	P < 0.001

a,b,c: Data with different letters are significantly different at P < 0.001.

Speaking about OMD, significant differences between treatment appeared applying to the crop one or more cuts. The best values correspond to rye-grass and Fronteira triticale cultivar.

IV – Discussion

Results match up with the ones consulted in reference bibliography, as authors like Delogu *et al.* (2002) suggest, for similar climate conditions, DM yields between 12.9 and 16.3 MT ha^{-1}, for triticale cultivars. This is supported by Peltonen-Sainio y Järvinene (1995) studies where they express that the more is the rainfall in the growing stages the better is the productive potential in triticale. That could explain why in this experiment triticale productions are higher than the ones obtained by Caballero *et al.* (1995), where rainfall were noticeably lower than in the present work.

Regarding CP, it decreases in the course of plant life due to the organs differentiation (leaves, stem and spike). On the other hand, CP and OMD values are similar, in parallel moments of cut, to the ones

referred by Carrasco López *et al*. (1999) and Llera *et al.* (1999), who obtained CP values near to 20%. Rojas *et al.* (2004) show in their studies an OMD between 54 y 57% in triticale cultivars. Fibre results from this study are higher to the ones indicate by Maçãs (1999) (in early growth stages), but lower to the ones referred by other papers (Caballero *et al.*, 1995), although rainfall in these works were lower to the ones appeared in this study. All this is in agreement with Sinclair y Senligman (1995), who explained that the lower was the rainfall in growth stages, the faster rises the leaf/stem ratio, increasing the lignification process therefore, the amount of fibre in the forage.

V – Conclusions

Although this experience is planned for 3 years and the one-year-conclusions must be taken having caution, it can be inferred that moment of cut has an important influence in forage quantity and quality, decreasing the DM yield and fibre values but increasing the CP and OMD values the earlier the cut is applied. The best option to manage the crop is the one including grazing in winter and cutting at the end of the season to preserve the forage for summer.

Acknowledgements

The authors thank Paulo Pires and Javier Sánchez Llerena for their skilled technical assistance and their invaluable help in collected samples.

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