# Production, nutritive and feeding value of Portuguese Mediterranean annual type rainfeed pastures – Castelo Branco


## ABSTRAT

Subterranean clover pastures (SC) have a higher nutritive value than Portuguese natural pastures (NP). However, this assumption does not include anti – quality factors and potential intake (determined by stocking rates - SR). Therefore, we tested the hypothesis that advantages of SC over NP are different if we consider feeding value (FV= nutritive value x intake x SR) instead nutritive value (NV) alone. Productivity of SC and NP was compared at Castelo Branco region, Portugal. Nutritive value components used for contrasts were: dry matter (DM), metabolizable energy, crude protein (CP) and ADF concentrations. Nutrient requirements of a merino ewe (50 kg live weight, 0.53 kg milk day$^{-1}$ in 150 days) were considered. Minimum levels assumed for daily intake were 1.48 kg DM with 21% ADF and 40% DM. NV results per se do not match with FV. Apparently, NV limits milk production only in the end of spring, due to CP%. However, considering FV and the limitations to intake, autumn and winter periods presented



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*stronger limitations to sheep production on SC than NP. To achieve nutritional balance, SC demand more roughage per year and ewe than NP: roughage 90 kg vs 45 kg and less concentrate 11 kg vs 12 kg, respectively.*

**Keywords:** Biodiverse pastures, natural pastures, subterranean clover, grazing, nutrition

## 1. INTRODUCTION

Mediterranean pastures consist mainly in annual species which undergo strong variations on their nutritional value along the year (Molle et al., 2008). In Portugal, after 1989, Mediterranean pastures surface increase from 828 691 ha to 1 738 185 ha (2009); this was mainly due to natural pastures (NP) increase - 77% from total (INE, 2012). For the same period, the area of improved and sown annual varieties, e.g. subterranean clover (Trifolium subterraneum L) and other annual legumes (Trifolium sp, Medicago sp, Ornithopus sp) mixtures (SC) remain almost constant (INE, 2012). Several research reports (from Almeida, 1988 to Barradas et al., 2006) highlighted the advantages of these mixtures, both on DM yield and on their nutritive value, which would allow higher stocking rates (SR) as compared with NP. However, until now, any research presented the feeding value of this pastures, i.e. the interaction of DM intake (allowed by pasture growth limited by SR) and nutritive value. Therefore, considering that intake is determined by both factors - nutritive value and pasture DM availability per animal (Avondo et al., 2002) - we tested the hypothesis that 'feeding value' of SC relative to NP would be different from the nutritive value comparisons per se. Lactating merino ewes (50 kg live weight) were used as reference.

## 2. MATERIALS AND METHODS

In a RCB design the natural pasture (NP) was compared with a sown subterranean clover mixture (SC), in a lithosol under a Mediterranean climate at Castelo Branco, Portugal. Three replicates and 660 $m^{-2}$ per plot, were grazed by lactating ewes in five cycles; botanical composition for the growth period by Levy-quadrat method (% legumes and grasses); pasture samples were collected before and after grazing, for growth and nutritive value determination. Total dry matter (DM) and crude protein (CP) were determined according to AOAC (2000); acid detergent fiber (ADF) according to Van Soest et al. (1991); metabolizable energy (ME) by prediction equations (NRC, 2007 and Bath and Marble, 1989, cit. by Coppock, 1997).

Daily nutritional requirements of a merino ewe (50 kg live weight, 0.53 kg milk $day^{-1}$ in 150 days) were considered (NRC, 2007): 1.48 kg DM intake, 11.81 MJ ME, 153 g CP and 311 g ADF. Average SR were derived from 50% annual total DM production according to Dikman (1998), divided by annual ewe intake. Feeding values per period time were obtained by the difference from Pasture availability (daily kg DM x nutritive value $kg^{-1}$ DM) to ewe requirements (SR x DM intake $ewe^{-1}$ x nutrient). Univariate anova (GLM) and Bonferroni tests for LSMeans were used to statistical analysis.

## 3. RESULTS AND DISCUSSION

Botanical composition changed for the growth period (Fig. 1): percentage of legumes increased (Pasture type $P<0.01$) in contrast with the decrease of grasses (Pasture type not significant). SC pastures had a higher legumes percentage, as comparing with NP, after 106 days of growth).

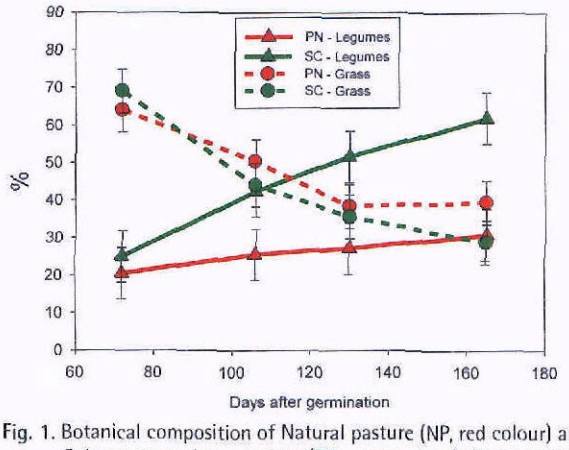


Fig. 1. Botanical composition of Natural pasture (NP, red colour) and *Subterranean clover pasture (SC, green colour) after germination*: % Legumes (solid lines; triangles); % grasses (dash lines; circles). Statistical significance for Legumes $P<0.01$ (Pasture type); Grasses ns (Pasture). 2 x Standard errors (SE).

Except for the winter period (73-116 days) pasture growth was significantly higher in SC, as comparing with NP (Tab. 1). Nutritive values (Tab. 1) showed higher CP concentrations in SC after day 117 of growth; SC had statistically higher ME concentrations and lower ADF concentration but no significance on Pasture type x growth

Tab. 1. Natural pasture (NP) and Subterranean clover pasture (SC) growth (kg DM $ha^{-1}$ $day^{-1}$) at different periods after germination (0= average germination date) and nutritive values. Standard errors (SE), Statistical significance for Pasture type (Past) and Pasture type x growth period (Past x per) effects.

| Period (days) | Pasture growth | | CP (g $kg^{-1}$ DM) | | ME (MJ $kg^{-1}$ DM) | | ADF (g $kg^{-1}$ DM) | |
|---|---|---|---|---|---|---|---|---|
| | NP | SC | NP | SC | NP | SC | NP | SC |
| 0-72 | 4.1 | 5.4 | 223 | 179 | 9.6 | 9.5 | 248 | 255 |
| 73-116 | 3.5 | 3.7 | 221 | 223 | 9.6 | 10.1 | 248 | 200 |
| 117-150 | 11.0 | 23.0 | 155 | 232 | 9.2 | 9.8 | 287 | 235 |
| 151-165 | 42.0 | 59.1 | 100.0 | 186 | 9.0 | 9.5 | 305 | 255 |
| 166-201 | 11.8 | 38.1 | 68 | 78 | 7.9 | 8.0 | 399 | 392 |
| SE | 3.0 | | 11 | | 0.2 | | 14 | |
| Past | P<0.001 | | P<0.01 | | P<0.01 | | P<0.01 | |
| Past x per | P<0.01 | | P<0.001 | | ns | | ns | |

period. From the nutritive values, as suggested by Molle et al. (2008), we would expect unbalanced CP:ME ratios on both pastures: for the first 150 days above requirements (12,96 g CP MJ $ME^{-1}$); after day 166, bellow CP:ME ratio, in NP, thus limiting milk production, reinforced by higher values of ADF.

Differences in total pasture DM production resulted in SR of 3.55 and 6.74 ewes $ha^{-1}$ in NP and SC, respectively. Considering these SR, pasture growth for the first 116 days was not enough to ensure daily DM intake per ewe (Tab. 2); this effect seems to be enhanced by the very low fiber availability, revealed trough an apparent unbalance on ADF requirements. Avondo et al. (2002) showed for Mediterranean pastures with CP higher than 16% DM, an intake limitation if biomass falls below 1 t $ha^{-1}$; that was the case in our results (pasture accumulated growth was 447 and 547 kg DM $ha^{-1}$ in NP and SC, respectively for the initial 116 days). Our feeding values estimations, for the same period (Tab. 2), showed a tendency, but not significant, of higher CP, ME and ADF, in the NP. For the following growth periods, CP was higher in SC, ME was higher in NP for 151-165 but lower for 166-201 days and ADF higher in NP for 166-201 days of growth. However, in these growth periods, NP feeding values were still enough to ensure ewe nutritional requirements, at the studied SR levels, therefore not limiting animal production.

Negative feeding values highlighted from table 2, can be balanced with roughage and concentrates supplementation. Carrying out this exercise resulted in different supplementation quantities per ewe for the whole growth period, on SC as comparing with NP: roughage 90 kg vs 45 kg and concentrate 12 kg vs 11 kg, respectively.

## 4. CONCLUSION

Nutritive value alone seems to be a weak indicator of Mediterranean pastures production potential. In our study, NP lower nutritive value as comparing with SC, contrasts with non-limiting NP feeding values, to lactating merino ewes, at the studied SR levels. Therefore, pasture intake (determined by growth and SR) should be considered together with nutritive values, to evaluate Mediterranean pastures production more accurately.

Tab. 2. Natural pasture (NP) and Subterranean clover pasture (SC) daily feeding values per ewe, at stocking rates of 3.55 and 6.74 ewe ha-1, respectively for NP and SC. Standard errors (SE), Statistical significance for Pasture (Past) and Pasture x period (Past x per) effects.

| Period (days) | Pasture intake (g $ewe^{-1}$) | | CP (g $ewe^{-1}$) | | ME (MJ $ewe^{-1}$) | | ADF (g $ewe^{-1}$) | |
|---|---|---|---|---|---|---|---|---|
| | NP | SC | NP | SC | NP | SC | NP | SC |
| 0-72 | -0.33 | -0.68 | 103 | -32 | -0.8 | -4.2 | -26 | -107 |
| 73-116 | -0.50 | -0.94 | 64 | -5 | -2.3 | -6.3 | -73 | -202 |
| 117-150 | 1.62 | 1.93 | 314 | 634 | 16.5 | 21.5 | 588 | 490 |
| 151-165 | 10.35 | 7.29 | 1006 | 1465 | 94.0 | 71.7 | 3309 | 1917 |
| 166-201 | 1.84 | 4.17 | 71 | 301 | 14.4 | 33.2 | 1011 | 1902 |
| SE | 0.57 | | 71 | | 5.2 | | 195 | |
| Past | ns | | P<0.01 | | ns | | ns | |
| Past x per | P<0.01 | | P<0.01 | | P<0.05 | | P<0.001 | |

## 5. REFERENCES


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