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Medicago polymorpha L. forage production and its quality when grazed by ewes

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Summary - In order to assess the forage availability and the quality of *Medicago polymorpha* L. used on dairy sheep Mediterranean system, a research was carried out during 1998. Dry matter availability and chemical composition were measured during the grazing period. At maturity the pod production and the seed components were assessed. Average forage availability was above 1.5 t DM ha⁻¹ in winter-spring period. Chemical composition of burr medic was characterised by a high crude protein and a low fibre fraction level. The pod production could be considered more than optimal to make a seed bank (3.1 t ha⁻¹). These preliminary results show that burr medic is an interesting species regarding the nutrition of dairy ewes.

Key-words: *Medicago polymorpha* L., quality, seed production, dairy ewes, grazing management

Résumé - Quantité et qualité du fourrage produit par une prairie de *Medicago polymorpha* L. pâturée par des brebis. Un essai a été mené en 1998 pour évaluer la disponibilité et la qualité du fourrage de *M. polymorpha* utilisée dans les systèmes pour brebis laitières en milieu Méditerranéen. La disponibilité en matière sèche et la composition chimique ont été mesurées pendant la saison de pâturage. La disponibilité moyenne en fourrage a été d'environ 1.5 et 5.5 t MS ha⁻¹ respectivement en hiver et au printemps. La *M. polymorpha* montre une composition chimique riche en protéine brute et pauvre en composants pariétaux. Ces premiers résultats montrent toute l'intérêt de la luzerne annuelle pour l'alimentation des brebis laitières.

Mots-clés: *Medicago polymorpha* L., qualité, production de semence, brebis laitière, maîtrise du pâturage

Introduction

In the Mediterranean environment the principal constraint to production is the concentration of the rainfall during the cold winter season and its total absence during the hot summer with a high intra and inter annual variability. Grasslands are characterised mainly by annual grasses and legumes, most of them escape over summer as seed. The introduction of self-regenerating legume pasture in rotation with a short term winter forage crops represents an evolution of the traditional cereal farming system (Fois *et al.*, 1996) that could become a low input or organic systems ones thanks to the strongly persistent seed banks and the nitrogen fixation of the legumes. *Medicago polymorpha* L. offers a high quality forage in winter-spring period (Fois *et al.*, 1999) and also in summer thanks to the pod production that could be grazed by ewes (Sitzia and Fois, 1999). Taking into account both its high production of quality herbage in spring and the need of burr medic to set a high seed bank in the soil, the grazing management in this period became a real crucial point. With the aim to study dry matter quality and availability during the vegetative stage and the seed production after grazing by dairy ewes in *Medicago polymorpha* L. a trial was set up in the Mediterranean lowland.

Materials and methods

A surface of 1 hectare was sown on 5/11/97 with 40 kg of *Medicago polymorpha* L., vr. Anglona, in a flat calcareous soil, pH 7.5, at Bonassai Research Station, NW Sardinia. The

climate is Mediterranean with average annual rainfall of 569 mm, concentrate in the autumn-spring period, and average annual temperature of 16.5 °C. At sowing time burr medic received 100 kg ha⁻¹ of P₂O₅. Seedling establishment was recorded one week later (6 samples of 25x25 cm ha⁻¹). The sward was grazed by 24 Sarda dairy ewes (live weight 45 ± 0.8 kg, means ± standard error) during three grazing cycles, one week grazing period and one week rest period each, started on 26/02/98. The sward was rested to allow a self seeding at the beginning of the flowering stage (1/04/98). Before and after each grazing period the sward height (SH) by weighted-plate (48 measure ha⁻¹) and herbage mass (HM), by cutting 12x0.5 m² samples per ha, was measured. From each sample weed species were separated, the quality of herbage on offer and refusal was assessed for dry matter (DM), crude protein (CP) and NDF, ADF, ADL content. During the flowering stage a number of flowers and immaturity pods per node was counted from one branch per plant in 30 plants chose at random. For each plant a total number of branches and node were also recorded. The seed production was measured in June (12/06) when pods were fully mature. Pods from 20 sample per ha (25x25 cm) were collected and counted. A known number of it was threshed and the seeds were cleaned before counting and weighing. The number of seeds per pod, 1000-seed and 1000-pod weight were calculated. The ewes stayed at pasture all the day except during the two machine milking when received low amount of supplement (60 g head day⁻¹). Daily milk yield was recorded. Statistical analysis was performed on SH, DM, weed content and burr medic quality by ANOVA to asses the time effect.

Results and discussion

The rainfall was below the average with 482 mm, 55 % concentrated in autumn. The average daily temperature during winter was of 9.7 °C and never fall below 0°C. The emergence of burr medic occurred in 7 days after 63 mm rain. The seedling number was 496 (s.e. 64.93) per m². The sward grazing management started 106 days after the sown when the herbage mass was 1.5 t ha⁻¹. The herbage availability increased during the grazing season (Tab. 1).

Tab. 1- Sward height (SH), burr medic availability (BMA), weed dry matter and burr medic on offer quality measured before (B) and after (A) each grazing period.

Data	SH cm	BMA t/ha	Weeds t/ha	Chemical composition				
				DM %	CP % DM	NDF %DM	ADF % DM	ADL % DM
26/02/98	B 14.44 a	1.34 a	0.182 a	9.99 a	28.01 a	32.25 a	20.00 a	2.33 a
04/03/98	A 15.67 a	1.93 ab	0.036 b	10.66 ab	28.47 a	33.30 ab	20.22 a	3.46 ab
11/03/98	B 12.35 a	2.23 ab	0.058 b	10.85 bc	27.79 a	30.63 a	19.95 a	3.51 ab
18/03/98	A 15.22 a	2.30 ab	0.017 b	11.57 de	27.38 a	36.09 ab	23.28 ab	4.81 b
26/03/98	B 16.88 a	2.97 b	0.057 b	11.35 cd	27.33 a	34.32 ab	22.49 ab	4.03 b
01/04/98	A 13.18 a	2.45 b	0.030 b	12.21 e	23.70 a	39.62 b	26.54 b	6.66 c

Different letters within column indicate significant differences (P< 0.05)

No significant reduction in herbage on offer was tested after grazing. A significant linear regression was found between the total herbage dry matter (t ha⁻¹) and the sward height (cm; HM = -0.026 + 0.162 x SH, P<0.001, R²= 0.57). The incidence of the weeds was low and decreased after the first utilisation remaining at the 2% of the total biomass (Tab. 1). During the trial there was a significant increase in DM, NDF, ADF and ADL content (P<0.05), whereas no difference was found on CP content. The grazing activity did not affect the

herbage quality, however the low quality measured at the beginning of the spring was due to the switch of burr medic into the reproductive phase. The flowering started 139 days after the emergence. Each plant had, on average, 15.7 nodes per branch and 4.6 branches. The flower number per plant decreased from 206 (9/04) to 26.8 (21/05), whereas that of pods increased from 88.04 to 213.8 (8/05) then starts to decrease because of the pods, reached the fully maturity, came off (Fig. 1).

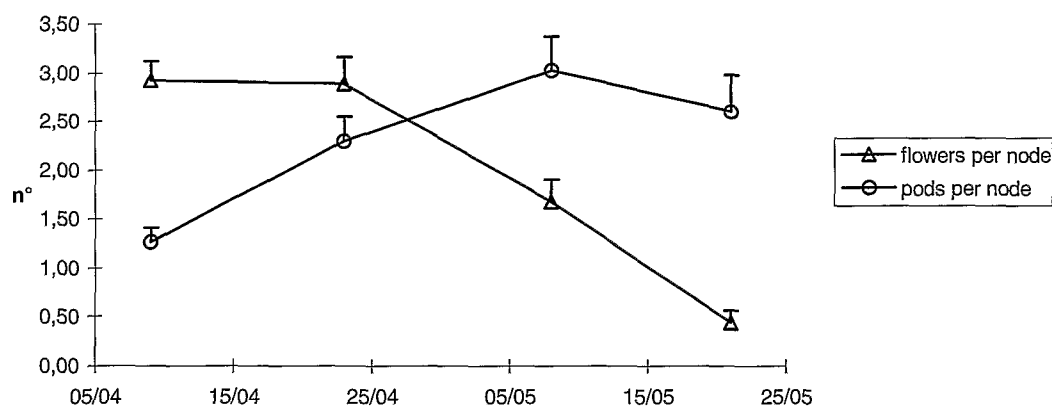


Fig. 1 - Flower and pod number counted at each node (means + standard errors).

The main features of seed and pod production is summarised in table 2. The seed production resulted in good agreement with Sitzia and Fois (1999), but it is higher than that measured in more rainfall environment (Cocks, 1995), probably because of the grazing activity before flowering that increase the seed production (Cocks, 1997). The resulting seed bank (44000 seed per m^2) is well above the number required for a high productivity (20000 seed m^{-2} , Osman *et al.*, 1991) and could assure a good re-establishment of the sward (Roberts, 1981).

Tab. 2 - Average seed and pod production and seed components of burr medic.

Seed production	$t ha^{-1}$	1.45
Pod production	$t ha^{-1}$	3.13
Number of pods / m^2	n° (x1000)	10.95
Number of seeds / pod	n°	4.02
Number of fertile seeds / pod	n°	3.56
1000 seed weight	g	3.30
1000 pod weight	g	28.58

During the 3 week grazing period total milk production was $735 kg ha^{-1}$ in 21 grazing days, the average milk yield was $1.46 kg head day^{-1}$. The total milk production was quite low because of the short utilisation period, however the individual milk yield resulted high.

Conclusions

Medicago polymorpha is an interesting annual legume in Mediterranean environment because of its winter-spring growth that could allow a higher stocking rate than that found in our trial. Furthermore its high quality has favourable consequences on milk yield. During the grazing season to assure a good seed bank the sward have to rest earlier respect to a non self seeding species. The high dry matter availability residual after the last utilisation and the high seed production obtained seems to suggest that to rest the sward at the beginning of the flowering stage could be a good management particularly in the first year of sown, when is very important to make a high seed bank for a long term persistence of the sward, moreover this high pod and stubble production could be considered an important feedstuff for grazing ewes in summer (Fois *et al.*, in this volume). Nevertheless further research are needed to investigate the carrying capacity of burr medic in early spring and the influences of stocking rate and grazing management on its seed production.

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