Leguminous forage crops of different origin in Mediterranean environment

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in

Sulas L. (ed.).
Legumes for Mediterranean forage crops, pastures and alternative uses

Zaragoza : CIHEAM
Cahiers Options Méditerranéennes; n. 45

2000
pages 153-156

Leguminous forage crops of different origin in Mediterranean environment

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Summary - In a hilly area of Southern Italy (Apulian Murgia) the adaptation and productive capacities of a tropical legume, Lotononis (*Lotononis bainesii* L., cv. Miles) and a Spanish spontaneous alfalfa, Mielga (*Medicago sativa* L.) have been evaluated in comparison with an Italian alfalfa (*Medicago sativa* L., cv. Garisenda). All of the species were grown under dry conditions and submitted to two levels of phosphoric fertilizer (50 and 100 kg ha^{-1} of P_2O_5). The data obtained in the first two years of the trial (1996 and 1997) show that both Lotononis and Mielga grow well in an environment characterized by hot-dry climate and by soils with low fertility, supplying good productions of green forage and satisfactory contents of crude protein and neutrodetergent fibre. With reference to the effects of phosphorus doses, the best responses have been obtained with the application of 100 kg P_2O_5 ha^{-1}, with differences almost always significant to analysis of variance.

Key-words: alfalfa, lotononis, adaptation, production, quality

Résumé *- L'étude a été développé dans la cote d'une région du Sud d'Italie (Murgia des Pouilles) avec le but d'évaluer l'adaptation et les capacités productives d'une espèce légumineuse tropicale, Lotononis (*Lotononis bainesii *L., cv. Miles) et d'une luzerne spontanée espagnole, Mielga (*Medicago sativa *L.), en comparison d'une luzerne italienne (*Medicago sativa *L., cv. Garisenda). Tous les espèces examinées ont été cultivées sans irrigation et soumises à deux niveaux de fumure phosphorique (50 et 100 kg* ha^{-1} *de* P_2O_5*). Pendant les premières deux années d'essai, 1996 et 1997, Lotononis et Mielga ont montré de bien s'adapter au milieu caractérisé par climat chaud-sec et sols avec basse fertilité, en fournissant des bonnes productions de fourrage vert et contenu satisfaisant de protéine brute et de fibre neutrodetergent. Quant aux effets des doses du phoshore, les meilleures réponses ont été obtenues avec le niveau de 100 kg* ha^{-1} *de* P_2O_5*, avec différences presque toujours significatives à l'analyse statistique.*

Mots-clés: *luzerne, lotononis, adaptation, production, qualité*

Introduction

In the semi-arid areas of Southern Italy, as the Apulian Murgia - a hilly inland zone characterized by poor and shallow soils and by the erratic rains, the bad management of natural resources has often determined their progressive marginalization.

The social-economic need to recover such districts, also through the gradual revaluation of small-medium family-run sheep and goat breeding, requires a greater knowledge of autochthonic fodder crops and, at the same time, the study of species of different origin but potentially able to adapt well to a new environment (De Franchi *et al.*, 1995; Maiorana *et al.*, 1995).

The Agronomical Research Institute of Bari has carried out, in different environments of Southern Italy, several researches on grasses and leguminous forage crops (Maiorana *et al.*, 1986; Convertini *et al.*, 1997; Maiorana *et al.*, 1997). Considering that legumes can improve and/or conserve soil fertility, reduce fertilizer inputs, maintain soil cover and therefore prevent soil erosion, increase biological efficiency of pastures and meadows, the aim of this paper is to compare some perennial legumes for forage and to evaluate their adaptation and productive capabilities.

Materials and methods

The experiment, started in autumn 1995 at Rutigliano (41° 01' latitude N, 4° 39' longitude E), on the Experimental Farm of the Institute.

Soil of the experimental site is classified as Rhodoxeralf Lithic Ruptic and the climate is "accentuated thermomediterranean" (UNESCO-FAO classification).

On plots of 4 m^2 each (2 x 2), laid out in a randomized design with three blocks, the following fodder crops were compared:

1. **Lotononis** (*Lotononis bainesii*, cv. Miles). Supplied by the C.S.I.R.O. (Australia), it is a creeping prostrate perennial legume native of South Africa; it is one of the most palatable tropical legumes, compares favourably in nutritive value with alfalfa and provides high yield and protein-rich fodder.
2. **Mielga** (*Medicago sativa* L.). It is a Spanish spontaneous rhizomatous alfalfa, with high tolerance to grazing and to arid conditions, good persistence capacity in the time and good palatability (Delgado Enguita and Hycka Maruniak, 1991).
3. **Italian alfalfa** (*Medicago sativa* L., cv. Garisenda). It is one of the most spread legumes in Italy, has erect or semi-erect growth habit is drought-resistant and able to provide good green forage productions in all conditions.

The species were sown from November 1995 (Mielga and Italian alfalfa, both with a rate of 30 kg seed ha^{-1}) to June 1996 (*Lotononis*, with 20 kg ha^{-1}) on 10 rows 20 cm apart and were fertilized every year, in autumn, with two phosphorus levels (50 and 100 kg P_2O_5 ha^{-1}).

Crops are grown under dry conditions, except a post-sowing irrigation of 300 m^3 ha^{-1} of water.

At the harvest-time, the green forage productions are determined, excluding the two exterior rows of plants for every side of each plot; on samples of forage of 1,000 g, oven-dried at 105 °C till a constant weight, the dry matter content is measured, while on samples of 100 g the contents of crude protein (N Kjeldahl x 6,25) and of neutrodetergent fibre (NDF, Van Soest) are determined after oven-drying at 80 °C for 24-36 hours.

In this paper, only the yields of green forage and the most important qualitative parameters of production relative to the first two years are reported.

The data have been subjected to analysis of variance (SAS Institute, 1998) and the differences among the averages evaluated by means of SNK test.

Results and discussion

During the trial period, the weather was characterized by an annual rainfall lightly higher than the 1977-1995 long-term average (627.2 and 613.1 mm in 1996 and 1997, respectively, vs. 606.2 mm). Particularly, in the first year there was a good winter and spring rainfall (477 mm of rains) that allowed either a good emergence of two *Medicago*, or a good water supply in the soil, before the summer sowing of *Lotononis*. Finally, in both years, the average monthly temperatures were more or less similar to those of previous period 1977-1995.

Forage crops showed emergence rates equal to 75% for *Lotononis*, 85% for Mielga and 100% for the Italian alfalfa. In the following year (1997), the two *Medicago* were earlier than *Lotononis* in resumption of the vegetative cycle after the winter break (April vs. May); besides, in all of three crops the persistence capacity over time was satisfactory, with a degree cover of plots almost unvaried.

Table 1. Effects of experimental factors on quanti-qualitative parameters of production.

	Green forage (t ha^{-1})	Dry matter (t ha^{-1})	Protein (%)	NDF (%)
Years				
1996	24.0 b	6.5 b	18.0 a	36.7 b
1997	39.9 a	10.3 a	15.7 b	40.4 a
Species				
Lotononis	30.8	7.8	15.0 c	42.0 a
Mielga Alfalfa	27.9	7.7	18.2 a	36.0 c
Italian Alfalfa	37.1	9.7	17.4 b	37.6 b
P_2O_5 Levels				
50 kg ha^{-1}	29.5 b	8.0 b	16.8	38.4
100 kg ha^{-1}	34.4 a	8.9 a	16.9	38.7

Values with different letters in the columns are significantly different at $P \leq 0.05$ (Student - Newman - Keuls test).

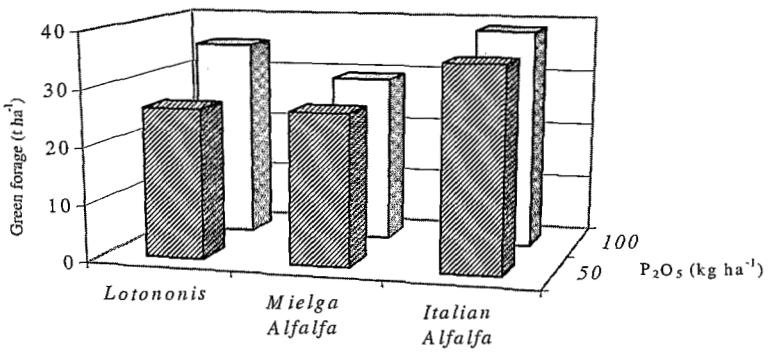

Figure 1. Effects of "crops x phosphorus doses" interaction on green forage productions.

Table 1, in which the main quantitative and qualitative parameters of production are reported, points out very interesting results, even if it would be better to evaluate the yields of green forage not in absolute terms, but in comparative ones, because of the small plots surface.

The best responses were obtained by the three legumes in 1997, whether for green forage (39.9 t ha^{-1}) and dry matter production (10.3 t), or for neutrodetergent fibre content (40.4%), with statistically significant differences. The worst productive values of 1996 depended not only on the seasonal climatic trend during the cuttings season and on the ability of legumes to achieve the highest productions in the second year from sowing, but also on the low cuttings number of *Lotononis* (only 1, in September), owing to of its later sowing-time. With reference to this legume, very interesting appears, always in the first year, the green forage yield (18.3 t ha^{-1}), in comparison with those of Mielga (25.6 t ha^{-1}) and Italian alfalfa (28.1 t), since it has been obtained with only a cutting, vs. the four ones of the other two species.

Among fodder crops tested, the best yielding results were achieved by the Italian alfalfa (37.1 t ha^{-1} of green forage and 9.7 t of dry matter), the lowest by Mielga (27.9 t and 7.7 t ha^{-1}, respectively), even if with not statistically significant differences. On the contrary, significantly better were the values of protein in Mielga (18.2%) and of NDF in *Lotononis* (42.0%).

With regard to phosphorus doses, the rise in values of quantitative and qualitative parameters as P_2O_5 levels increase was significant for green forage (from 29.5 t to 34.4 t) and for dry matter (from 8.0 t ha^{-1} to 8.9 t), but not for crude protein and neutrodetergent fibre, that showed contents of about 17 and 39%, respectively, for both P_2O_5 doses. The effects of fertilizer were mostly evident in *Lotononis*; in fact, the "crops x phosphorus doses"

interaction (Figure 1) shows as, in this crop, the application of 100 kg P_2O_5 ha^{-1} caused a statistically significant increase (over 30%) of green forage production (35.2 t ha^{-1} vs. 26.4 t obtained with the lowest dose), while in the Italian alfalfa (38.7 t vs. 35.6 t) and in Mielga (29.4 t vs. 26.5 t ha^{-1}) yields were almost the same.

Conclusions

The results obtained in the two-year study showed the following:

- *Lotononis* and Mielga are well-adapted to the climatic conditions of the trial environment and provided results quite similar to those of the Italian alfalfa, that confirmed to be a very good legume for forage.
- *Lotononis* reached a high number of cuttings (6) in the second trial year; it produced also during the warmer and drier months of the year (July and August), when the high temperatures and the rains lack stopped the productive stage of both Mielga and the Italian alfalfa, that started again with the first autumn rains; it notably increased the green forage yields with the highest phosphorus levels.
- Mielga was characterized by a fair production/quality balance, since it always showed the best crude protein contents, and by a sufficient number of cuttings (4) in the two trial years; it achieved constant productions of green forage in every climatic conditions and of agronomic management.

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