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Seasonal variation of leaf production for *Medicago arborea* and *Medicago citrina* under irrigation and drought conditions

E. Lefi*, M. Ben Younes and H. Medrano***
*Universidad de las Islas Baleares, Departamento de Biología,
Carr. Valldemossa, km. 7,5, 07071 Palma de Mallorca, Spain
**Ecole Supérieure d'Agriculture du Kef (ESAK), Kef 7119, Tunisia

RESUME *– "Variation saisonnière de la production de feuilles chez* Medicago arborea *et* Medicago citrina *en irrigué et sous sécheresse". La dynamique de la production de feuilles chez les arbustes fourragers le long de l'année reflète les variations de la disponibilité des ressources fourragères. Les variations saisonnières du taux d'apparition des feuilles (LAR), du taux de sénescence foliaire (LSR), de la taille finale des feuilles (LA) et de la surface foliaire par tige (TLA) ont été étudiés au champ sur des plantes de* Medicago arborea *(MA) et* Medicago citrina *(MC), en conditions irrigué et de sécheresse. En irrigué, MC a présenté des valeurs significativement supérieures à MA pour tout ce qui est LA et TLA. La production des feuilles a été similaire pour les deux espèces et elle a été plus basse en hiver. Durant le printemps, cette production a été élevée pour MC. En conditions de sécheresse, MC a présenté des valeurs plus élevées de LAR que MA au début du printemps et à la fin de l'automne, et de TLA au début du printemps. MA a maintenu une sénescence des feuilles plus marquée à partir du mois de Janvier et durant le printemps.*

Mots-clés : Medicago *sp. arbustes fourragers, espèces endémiques, sécheresse*.

Introduction

Under Mediterranean environments, legume shrubs present an increasing interest as forage plants and possible barriers that contribute to reduce soil erosion (Andreu *et al*., 1998). The use of shrub species of *Medicago* genre, for these two aims, has promoted different studies on botanical and genetic aspects (Chebbi *et al*., 1995) as well as evaluations of its forage potential (Koning *et al*., 2000). Previous studies, of the agronomic behavior of these species under water stress, showed that *Medicago citrina* (MC) tolerates better the drought (Chebbi *et al*., 1994).

In the present work, different characters, related to the maintenance of leaf mass in MA and MC, were compared throughout the year under field conditions, evaluating the effect of soil water deficit on leaf production.

Materials and methods

Materials: In this paper, plants of *Medicago citrina* and *Medicago arborea* (seeds from Mallorca and Cabrera respectively, Balearic Islands) were compared under field conditions.

Methods: Once germinated in pots under greenhouse conditions, seedlings were transplanted in two adjacent parcels at the experimental field of the UIB, (35 plants of each species by parcel). One parcel was rainfed and the other one was maintained at field capacity. The measures were made on 2 years old plants from October 1999 to September 2000. Thus, the treatments were *Medicago arborea* and *Medicago citrina* in irrigation (MAR and MCR respectively), *Medicago arborea* and *Medicago citrina* in dry land (MAS and MCS respectively). In order to follow the dynamic of leaves production and senescence, 5 stems (one in each plant, with 3 to 4 leaves) for five different plants in each treatment were marked at the beginning of each station. The leaf appearance rate (LAR: the number of new leaves per day), the leaf senescence rate (SLR: the number of leaves at senescence state per day), the individual leaf area (LA, leaf completely expanded) and the total leaf area per stem (TLA: the product of the number of leaves by LA) were measured. The predawn water potential (Ψ) was measured once per month with a pressure chamber.

Results and discussion

Under irrigation, the water potential was around -0,45 MPa along the year (Fig. 1). Under drought, it was significantly reduced (Noitsakis *et al.*, 1991) since February for MA and MC, decreasing gradually in March and April, and quickly in May and staying at very low values during the summer.

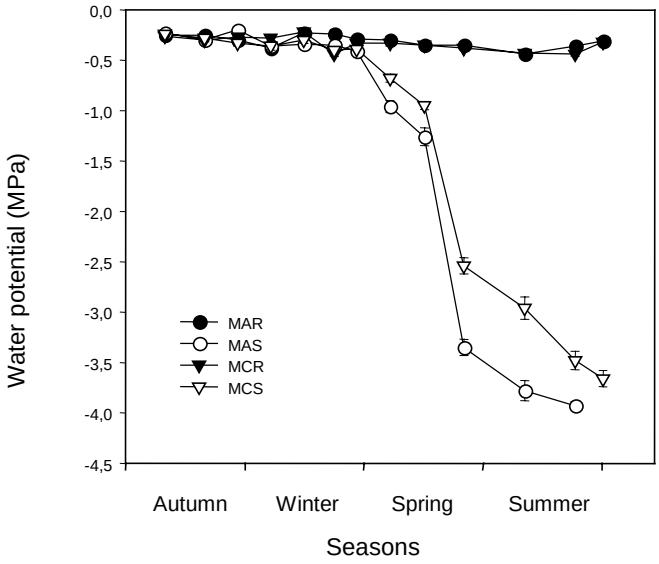

Fig. 1. Water Potential (Ψ) changes for two legumes shrubs during the seasons.

During spring and summer, MC maintained high values than MA. The LA of MC was always greater than MA with a pronounced reduction in July. In MA, LA stayed between 4.07 and 4.85 cm^2 along the autumn and winter seasons but increased during the spring to maximum values of 6.40 cm^2 (March) and was drastically reduced in July until 2.55 cm^2. In dry land, the LA decreased gradually since the month of February for the two species. Reductions achieved a 49 and 100% in spring and summer respectively for MA and a 40 and 66% respectively for MC.

During the autumn there were no significant differences between species and treatments for LAR (Fig. 2). The highest values were recorded in October for all treatments. MC maintained superior values than MA from March to June. Under drought stress, the maximum reductions were 54 and 87% for MA and MC respectively in spring. Reductions were 100% during the summer season (Chebbi *et al.*, 1994).

The variations of SLR showed a strong and coincident fall in summer under irrigation (July and August) and a moderate fall in March. Under drought, higher fall occured in December and March-April. Regarding the TLA (Fig. 3), under irrigation MC values was always greater than MA. The effect of soil water deficit marked significant differences since the month of March for the two species.

Conclusions

If we considered TLA at the end of every period as a representative value of the plant, in dry land, both species presented the maximum leaf growth in autumn, followed by a moderate growth in winter. During the spring and summer seasons, both treatments (irrigation and drought) showed differences in final values. For all stations and both treatments, the leaf area of MC is widely higher than for MA. Under irrigated treatment, total production of leaves for MC was twice higher than MA and the reductions due to drought were similar (50% for MA and 44% for MC).

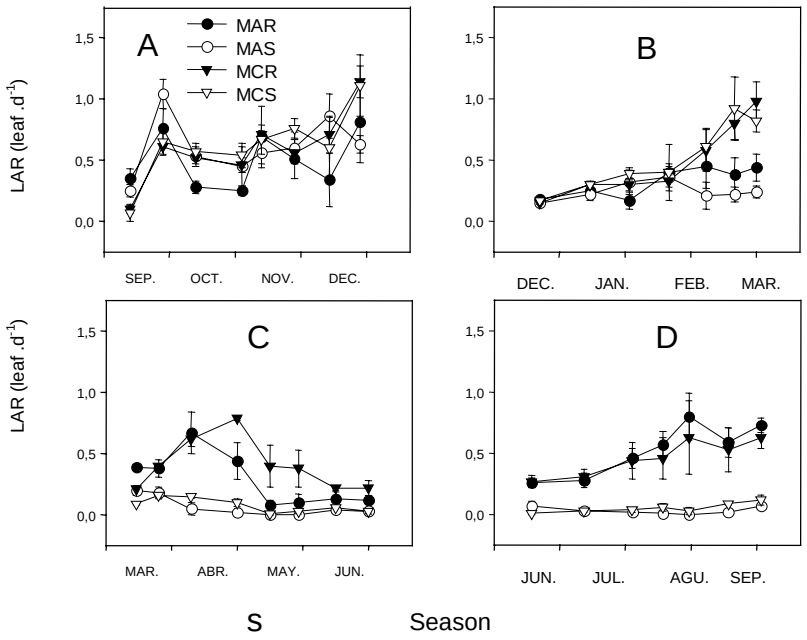

Fig. 2. Changes in leaf apparition rates (LAR) of two legume shrubs during autumn (A), winter (B), spring (C) and summer (D).

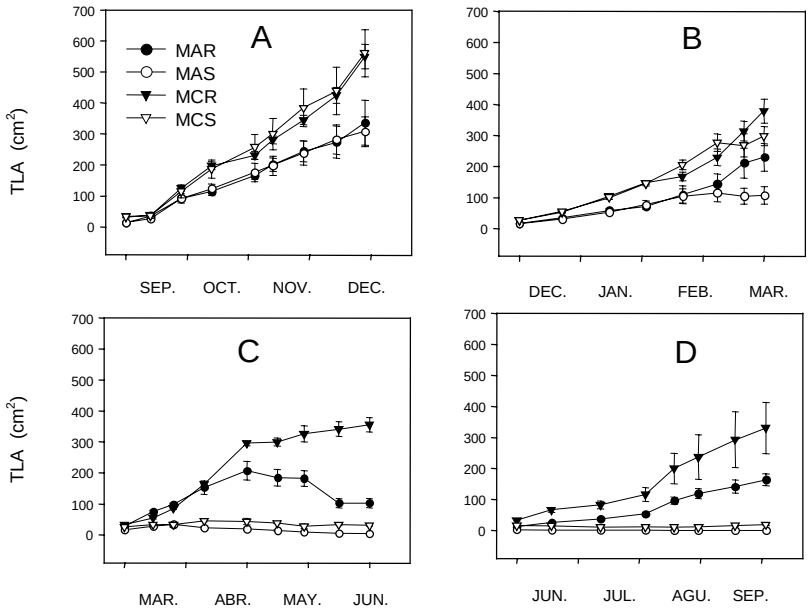

Fig. 3. Changes in total leaf area per stem (TLA) of two legume shrubs during autumn (A), winter (B), spring (C) and summer (D)

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