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Medicago arborea - a leguminous fodder shrub for low rainfall farming systems

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Summary - Currently there are no suitable highly nutritious/palatable leguminous fodder shrubs for low rainfall calcareous soils of southern Australia. Preliminary evaluation of *Medicago arborea* has shown it has leaves with 20% crude protein and 79% digestibility. *M. arborea* has the potential to become a low rainfall zone fodder shrub in a similar way to the success of Tagasaste (*Chamaecytisus proliferus*) in the medium rainfall neutral acid soil zone. The agronomic and environmental benefits (alley farming and plantations systems to reduce wind and water erosion) of utilising *M. arborea* are being investigated. Trials will examine the grazing strategies, fertiliser requirements and plant densities needed to maintain productive plantations. *M. arborea* shows promise for the improved sustainability of fragile soils in low and medium rainfall farming systems in Mediterranean type environments.

Key-words: *Medicago arborea*, fodder shrub and calcareous soils

Résumé - Il est rare de trouver des arbustes fourragers appétents et à forte valeur nutritive, adaptés aux sols calcaires en zone à faible pluviométrie en Australie du sud. Une évaluation préliminaire de *Medicago arborea* a montré que ses feuilles contiennent 20% de MAT avec une digestibilité de 79%. Cet arbuste peut donc jouer, en zone aride, un rôle similaire à celui du tagasaste (*Chamaecytisus proliferus*) en zone semi-aride sur sol acide à neutre. Les recherches portent sur les avantages agronomiques et environnementaux (réduction de l'érosion hydrique et éolienne) de *M. arborea*. Le dispositif expérimental prévoit d'étudier la gestion pastorale, les besoins en fertilisation et la densité de plantation optimale pour garantir une production soutenue de la plantation.

Mot-clefs: *Medicago arborea*, arbuste fourrager, sol calcaire

Introduction

Medicago arborea (Tree Medic) is a perennial woody leguminous shrub which can grow between 2 - 4 m high under favourable conditions. *M. arborea* originates from the Mediterranean region where it is currently found growing in rocky dry calcareous soils from the Canary Islands and Balearic Islands along southern Europe to Asia Minor (Lesins and Lesins 1979). It is very drought tolerant (<250 mm annual rainfall) and will also grow well in sandy soils. *M. arborea* is also cold tolerant and has been found to survive 66 frost days at Terbol - Lebanon and 44 days frost at Tel Hadya - Syria (ICARDA Annual Report 1997). The good forage quality of the species was recognised by ancient Romans and Greeks (Lesins and Lesins 1979).

M. arborea has been shown to reduce soil erosion caused by water in Spain (Andreu *et al.* 1994, 1995 and 1998). *M. arborea* has the potential to fulfil a dual role on calcareous and sandy soils with low rainfall in southern Australia and areas of similar climate around the world, particularly in the Mediterranean basin. It could provide highly nutritious fodder whilst protecting fragile landscapes from wind and water erosion. *M. arborea* has the

potential to provide high quality green feed during the late summer and early autumn period when a significant feed gap occurs in Mediterranean climates typified by cool wet winters and hot dry summers. In addition, the use of *M. arborea* will help diversify farm enterprises in areas where few options are available to primary producers.

This paper summarises the available knowledge on *M. arborea* and presents results from preliminary investigations in South Australia. Future agronomic evaluation of *M. arborea* planned to commence in the year 2000 in South Australia is also described.

Materials and methods

Preliminary investigations: Nine accessions of *M. arborea*, two species of *Atriplex* and one accession of *Chamaecytisus proliferus* (Tagasaste) (Table 1) were grown in Adelaide (Long. 138°50' E, Lat. 35° S) and leaf crude protein and digestible dry matter determined using Near Infra Red Spectrophotometry. Thick (>5 mm) and thin (<5 mm) stems were also measured for crude protein and digestible dry matter for Tagasaste and the tree medic accessions. Aphid screening tests were also made. Further crude protein and digestible dry matter measurements will be made throughout the growing seasons year 2000 and 2001.

A small plantation (approx. 300 trees) was established using transplanted seedlings at Turretfield Research Centre (TRC), South Australia (Long. 138°50' E, Lat. 34°33' S) in July 1998. Rows were spaced 5 m apart, within a row plants were spaced 1 m or 2 m apart. At Booborowie, South Australia (Long. 138°45' E, Lat. 33°33' S) a small plot (1 x 2 m) was direct seeded and ten plants transplanted in July 1998.

Results and discussion

Preliminary investigations: The feed analyses revealed that leaves of *M. arborea* were similar to Tagasaste and *Atriplex nummularia* for leaf crude protein and substantially better than *A. amnicola*. (Table 1). The leaves of *M. arborea* were substantially more digestible than any of the other species. *M. arborea* stems under 5 mm in diameter were more digestible compared to Tagasaste (Table 1). Digestibility and crude protein of larger stems (>5 mm) had declined for all *M. arborea* accessions and Tagasaste (Table 1). Feed value of pods from *M. arborea* was high whereas Tagasaste pods would be considered to be very poor feed. (Table 1).

M. arborea seedlings are susceptible to Red legged Earth Mite (*Halotydeus destructor*). Aphid screening tests in the glasshouse have revealed *M. arborea* to be susceptible to Blue Green Aphid (*Acyrtosiphon kondoi*), Spotted Alfalfa Aphid (*Therioaphis trifolii*) and Cow Pea Aphid (*Aphis craccivora*) although the extent to which these will be a problem in the field is yet to be assessed. Sitona weevils (*Sitona discoideus*) were found on *M. arborea* at the TRC field site in early summer (December 1998), and whilst some typical leaf notching was observed the importance of Sitona damage in the field is at this stage uncertain. The plants were at least 7 - 8 months old at this stage. Seedlings at the TRC site were also attacked by European Hares and Little Corellas (members of Cockatoo family). Most plants recovered from this attack so long as they had at least 5 cm of stalk remaining. Plants at the TRC site began to shed their leaves in summer (mid January 1999), when conditions were very dry with no significant summer rainfall. Tree medic in southern Italy have been noted to enter dormancy during summer (Martiniello and Lamascese 1993). Sheep (8 months old) were introduced into the TRC plantation in February 1999 and any remaining leaf and small stems were eaten and plants reduced to bare stalks by the end of February. Plants made remarkable regrowth following 25 mm rainfall in mid March 1999. By the 31st August 1999 the average dry matter weight (leaf and stem <5 mm diameter) was 57g/plant (plants

approximately 14 months old). *M. arborea* established well in the direct seeded plot at Booborowie.

Table 1: The percentage crude protein and digestibility of leaf, thin stem (<5 mm), thick stem (>5 mm) and pod for nine *Medicago arborea* accessions, one tagasaste accession, two saltbush species and lucerne hay.

Accession	Crude Protein %				Digestible Dry Matter %			
	leaf	thin stem	thick stem	dry pod	leaf	thin stem	thick stem	dry pod
SA 8044	17.2	8.7	6.9	15.3	78.1	56.3	42.6	60.9
SA 22730	18.9	6.5	5.4	13.4	76.0	54.9	40.3	58.4
SA 22731	17.1	6.9	5.8	13.7	77.8	53.7	37.3	60.8
SA 26086	20.5	5.9	5.2	15.3	78.8	51.4	38.3	61.3
SA 26087	19.5	6.1	4.8	15.5	76.8	53.1	38.8	64.1
SA 30528	18.1	7.8	7.2	15.3	78.9	59.5	46.4	63.5
SA 32245	21.1	5.9	4.7	15.3	79.8	52.8	36.8	63.1
SA 32253	19.5	6.5	5.5	15.9	79.6	51.0	37.0	61.1
SA 32270	18.2	6.9	6.7	15.2	81.6	54.1	44.1	62.7
Tagasaste (SA 22699)	20.8	6.3	5.0	4.4	71.6	38.8	36.1	44.5
<i>Atriplex</i>	9.4	-	-	-	55.0	-	-	-
<i>Amnicola</i>								
A. <i>nummularia</i>	18.8	-	-	-	65.0	-	-	-
Lucerne hay	19.0	-	-	-	65.2	-	-	-

Conclusions

Medicago arborea has the potential to be a useful fodder shrub for low rainfall areas with Mediterranean type climates particularly on calcareous and sandy soils. The leaf material is of high quality and similar to Tagasaste in crude protein percentage but more digestible. Thin stems may also be eaten and these were on average slightly higher in protein than Tagasaste and much higher in digestibility. The pods of *M. arborea* were also high in protein and digestibility, whereas those of Tagasaste were very low in both protein and digestibility. It has the appeal therefore of being able to provide highly nutritious fodder while at the same time protecting fragile soils. The need for further work to select superior cultivars and determine best agronomic practices is clearly indicated.

Future Plans for Agronomic Research with *M. arborea*

Two large scale plantations (4 - 5 acres) will be established on commercial farming properties during 1999 and 2000. One plantation will be sited at Darke Peake, Eyre Peninsula, South Australia (Long. 136°12' E, Lat. 33°28' S average annual rainfall 350 mm) and the other site in a medium rainfall region, Apilla (Long. 138°25' E, Lat. 33°03' S. average annual rainfall 375 - 400 mm) At the Darke Peake site *M. arborea* will be compared with saltbush. Both sites will be used to determine the best grazing strategies such as frequent grazing every 6 - 8 weeks throughout the year and seasonal grazing whereby plants will be grazed once in summer and once in early winter.

Other issues that need to be addressed are:

- ♣ Nutritive requirements of the plants.
- ♣ Planting density experiments to determine the most economical and biologically sustainable plantation densities. Trial work in Greece have shown significant increases in *M. arborea* biomass are achieved through higher seeding rates (Bouzid and Papanastasis 1996).
- ♣ Direct drilling seed vs bare root seedlings (i.e. most economic methods of establishment). Direct seeding has been shown to be successful in establishing native trees and shrubs in low rainfall environments in South Australia (Knight *et al.* 1998).
- ♣ Wool growth and liveweight of sheep foraging *M. arborea*.
- ♣ Screening to determine resistance and tolerance to insect pests and diseases.
- ♣ Screening for anti-nutritional and toxic compounds eg. Coumestrol and alkaloids.
- ♣ Rhizo-biological studies to find the most effective root nodule rhizobium.

The main outcome from these agronomic trials will be management packages to help farmers utilise *M. arborea* in low and medium rainfall areas.

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