

Comparisons of new *medicago* spp. In south australia

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Summary. Comparisons of *Medicago* spp. not presently cultivated in Australia were made from two field evaluation trials conducted between 1992 and 1995. The trials were conducted on alkaline solonised brown loams (mallee soils) in an area with a mean annual rainfall of 440 mm predominately of winter incidence. On the basis of these trials *M. orbicularis*, *M. turbinata*, *M. constricta* and *M. blanchiana* warrant further investigations.

INTRODUCTION

This work is a collaborative project between the University of Adelaide, Roseworthy and the South Australian Research and Development Institute. It was conducted over a four year period (1992-1995). The work was initiated as the basis of undergraduate projects at the University to investigate the potential for cultivation of *Medicago* spp. not normally grown in South Australia.

Annual medics (*Medicago* spp.) are widely used as pasture legumes in ley farming systems of the wheat belts of southern Australia. There are no known native *Medicago* in Australia, and evidence suggests that their arrival in this continent dates to that of Europeans in the 18th century. They are now found in most suitable habitats south of the Tropic of Capricorn (3). Heyn (4) outlined the characteristics of 28 annual medic species, but the commercialized annual medic cultivars commonly grown in Australia represent only six of these species. The predominance of *M. truncatula* with numerous commercialized cultivars is due to its outstanding adaption to low rainfall environments with soils high in available lime and to long established understanding by farmers of how to manage the species for best results in terms of production and persistence (3). Although the value of annual *Medicago* was discovered in the late 1930's the intervening years have seen considerable advances in terms of plant improvements. This has been especially so since the mid 1960's and is continuing through the ongoing efforts of the National Annual Medic Improvement Programme funded by the GRDC. In addition to this work in Australia there is now an increasing interest in annual medics in other locations including Mediterranean climatic zones and the continental climates of Central and Western USA.

It was decided to investigate a broader group of species for dry matter and seed production performance in the Roseworthy environment. Material for this study was selected from the Australian *Medicago* Genetic Resource Collections (AMGRC) based with SARDI, Adelaide, which comprises some 20,000 accessions acquired from 60 countries (1). An initial experiment conducted in 1992 compared twelve different species and removed 5 accessions, *M. doliata* (SA8457), *M. rotata* (SA15030), *M. praecox* (SA23513), *M. minima* (SA4974) and *M. rigidula* (SA14022), from further evaluation based on poor dry matter production (7). The remaining accessions were thought to warrant further investigation.

METHODS

In 1993 seven accessions based on previous work (7), *M. arabica*-1 (SA10205), *M. turbinata* (SA2141), *M. aculeata* (SA8944), *M. truncatula* cv. Paraggio (SA3780), *M. orbicularis* (SA8450), *M. constricta* (SA8933), and *M. blanchiana* (SA2340) and three additional accessions also from the AMGRC collection, *M. intertexta* (SA7723), *M. arabica*-9 (SA3792) and *M. truncatula* cv. Caliph (SA27783), were evaluated in a field trial. The trial was conducted at The University of Adelaide's Roseworthy Campus, 50 km north of Adelaide on alkaline solonised brown loam soils (mallee soils) in an area with a mean annual rainfall of 440 mm predominately of winter incidence. Trial design consisted of a randomised complete block design with six replicates.

On 4 March 1993 glyphosate at 360 g a.i./ha and MCPB at 1 kg a.i./ha were applied to the field site in separate applications to control weeds. The trial site was cultivated with off-set discs on 28 May. Prior to sowing the medic plots, tall fescue was established at 114 kg/ha on 1 June between the plots. Over the period of the trial the grass was mown to control weeds. Medic plot areas were predrilled with triple super (20% P, 1.5% S) at 100 kg/ha on 18 June. A plague of mice delayed the sowing of medics. The medic plot rows were cultivated on 4 August prior to seeding. Medic seed was sown at 25 kg/ha into 1x2 m plots on 1 September. On 10 October Fluazifop-p at 53 g a.i./ha was applied to control grass weeds in the medic plots. Herbage cuts were made on the 12 November using 0.1 m² quadrats. On 24 December pods were harvested from 0.1 m² quadrats and yield of seed determined. In 1995, weeds were not controlled with herbicides to ascertain the ability of the regenerated medics to compete under weed competition. The weed population included wild oats, *Avena* spp., annual ryegrass, *Lolium rigidum*, indian hedge mustard, *Sisymbrium orientale*, marshmallow, *Malva parviflora*, and soursob, *Oxalis pes caprae*. Pasture cuts were made on 30 August 1995 and dry matter of *Medicago* spp. measured.

RESULTS AND DISCUSSION

April to October rainfall for the evaluation years was 1992 (463 mm), 1993 (300 mm), 1994 (180 mm) and 1995 (307 mm). Mean (79 year) April to October rainfall is 334 mm. A major shortcoming of this project was the delayed sowing caused by a plague of mice, however it was decided to sow the trial once it was clear that soil moisture reserves were sufficient to support the growth and development of the plants.

Table 1. Days to flowering of *Medicago* spp. after sowing date 1.9.93. at Roseworthy (Rswy) and Parafield (Para) (Parafield Data from different years and adjusted).

	Rswy Days	Para Days		Rswy Days	Para Days
<i>M. turbinata</i> (SA2141)	48	94	<i>M. aculeata</i> (SA8944)	62	107
<i>M. blanchiana</i> (SA2340)	49	102	<i>M. constricta</i> (SA8933)	63	98
<i>M. truncatula</i> (CALIPH)	55	85	<i>M. arabica-1</i> (SA10205)	65	118
<i>M. intertexta</i> (SA7723)	57	101	<i>M. arabica-9</i> (SA3792)	67	120
<i>M. orbicularis</i> (SA8450)	59	81	<i>M. truncatula</i> (PARAGGIO)	70	110

With most annual *Medicago*, flowering is accelerated by long days (2). This acceleration was particularly evident (Table 1) due to late sowing in 1993. The early flowering lines *M. turbinata*, *M. blanchiana*, *M. truncatula* (Caliph), *M. intertexta* and *M. orbicularis* produced the highest levels of seed with the exception of *M. intertexta* (Fig. 2). These medics performed well and proved to be prolific seed producers even with the short growth period. The dry matter yields (Fig. 1) of *Medicago* spp. tested showed no significant differences indicating all of the 10 species had potential for this environment. These measurements were made in a weed free sward. It should be noted that production is for the short growth period of 73 days. Regeneration in the dry 1994 season was low and dry matter production negligible. It was decided to measure production in the following regenerating ley year.

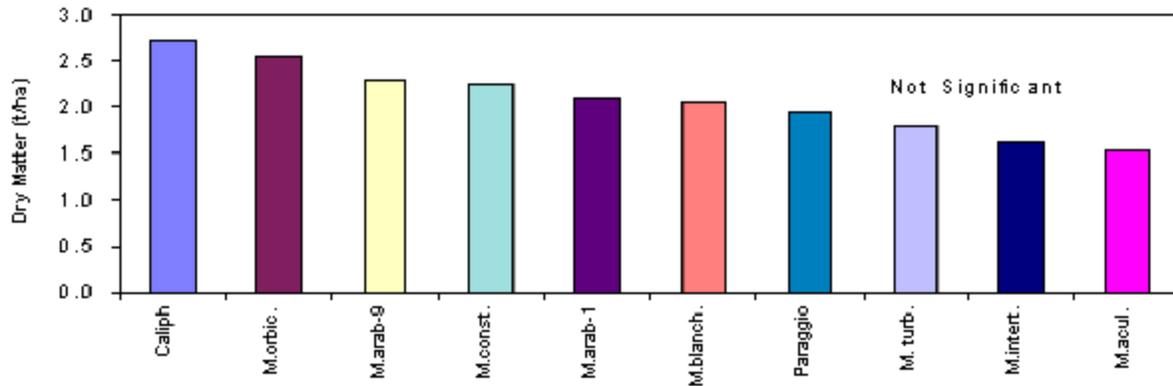


Figure 1. Mean dry matter yield of *Medicago* spp. (12 November 1993).

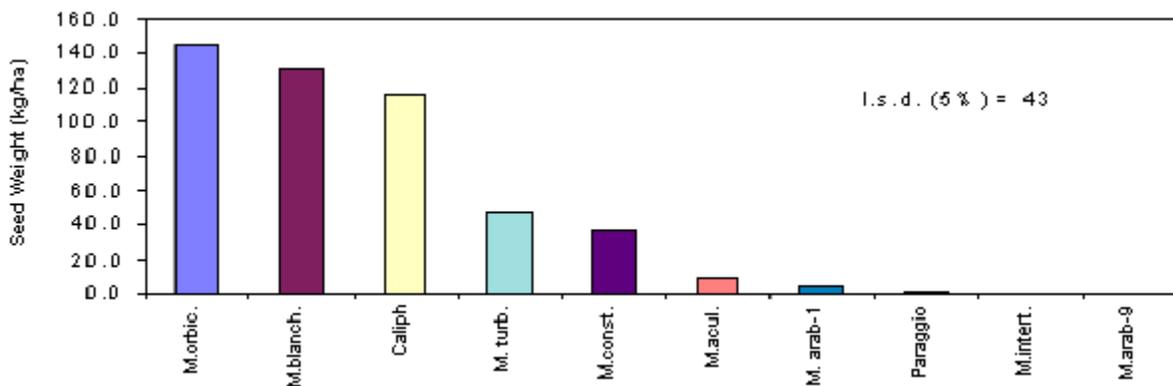


Figure 2. Mean seed yield of *Medicago* spp. (24 December 1993).

The seed yields (Fig. 2) of *M. orbicularis* and *M. blanchiana* were not significantly different from that of Caliph and all of these with the addition of *M. turbinata* produced significantly greater seed than Paraggio. *M. orbicularis* has been shown to be a prolific seed setter in other environments (6) however it exhibits erratic breakdown of hard seed making it a nuisance in crops and reducing the likelihood of a dense pasture in the ley year.

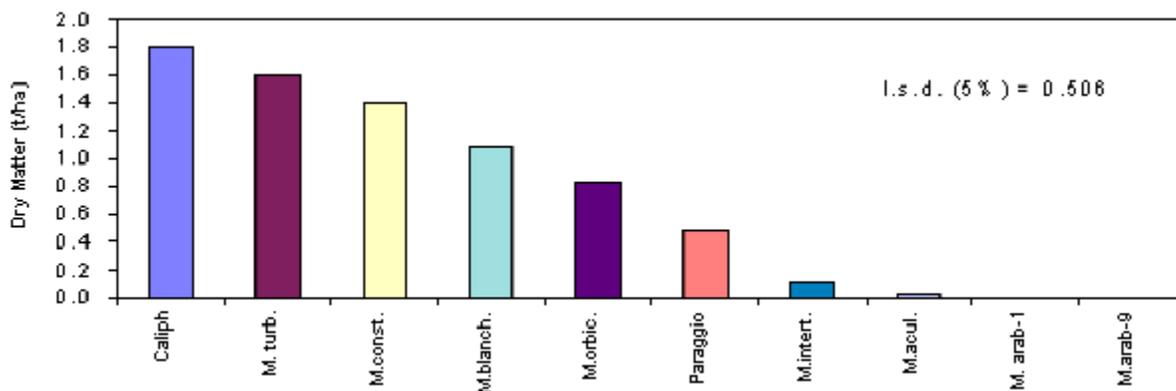


Figure 3. Mean dry matter yield of *Medicago* spp. under weed competition (30 August 1995).

The dry matter yields (Fig. 3) of Caliph, *M. turbinata* and *M. constricta* were not significantly different when allowed to regenerate with heavy weed competition. All of these medicos with the addition of *M. blanchearna* produced significantly greater yields of dry matter than the cultivar Paraggio. The dry matter production of Paraggio was higher than expected considering the low level of seed production in 1993. *M. arabica* despite performing well in a good season (1992) failed to set sufficient quantities of seed in 1993 owing to its late flowering. It was noted on 29 September 1995 that one of the lines in particular, *M. blanchearna* was being decimated by blue green aphids (*Acyrtosiphon kondoi*).

It would seem from this limited data set that at least 2 different species *M. orbicularis* and *M. blanchearna* are comparable to a recently released *M. truncatula* cultivar Caliph in both herbage and seed production. A third species *M. turbinata* warrants consideration for its ability to compete effectively with weeds (Fig. 3). These three species have the added advantage of having smooth pod characteristics which has shown to be of considerable importance to the wool industry (5).

CONCLUSIONS

M. orbicularis, *M. turbinata*, *M. constricta* and *M. blanchearna* warrant further investigation on the basis of this experiment particularly given their smooth, tightly coiled and compressed pod characteristics. Further studies into insect resistance or tolerance and hard seededness would be required before these species could be recommended for commercial evaluation.

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