Roles for new pasture legume species in Southern Australia

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Introduction

In the last five years three new pasture species have been developed for use in southern Australia (Medicago murex; M. polymorpha; Trifolium balansa) (see Table 1). In addition the release of new varieties of several species with quite different characteristics to older varieties has changed the role for these species (Ornithopus compressus; Trifolium resupinatum). Releases of new varieties of the species T. subterraneum, M. truncatula and M. littoralis have resulted in substantial improvements over previous varieties, but have not substantially changed the role for these species.

Table 1. Varieties of several species of annual pasture legumes released in Australia since 1983

Year of release	Species				
	M. polymorpha	M. murex	T. balansa	T. resupinatum	O. compressus
1983	Serena				
1984					
1985	Circle Valley				
1986			Paradana		
1987					Tauro Avila
1988	Santiago	Zodiac			Madeira Elgara
1989				Kyambro	

The first burr medic (M. polymorpha) variety, Serena, was released in 1983 followed by Circle Valley in 1985. The most recently developed variety, Santiago, was released in 1988. Burr medic has already been sown over an estimated 500,000 hectares in Western Australia (1) but at this stage has only been sown in Eastern Australia in small areas. With the release of Santiago, more extensive sowings are anticipated (1) both in Western Australia and elsewhere.

The first variety of murex medic (M. murex), Zodiac, was released in both New South Wales and Western Australia in 1988. Sufficient seed was produced to sow approximately 4000 hectares in 1989. With the release of earlier maturing varieties of murex medic in the next few years the area sown to this medic is expected to increase rapidly. Gillespie has estimated the potential area where murex medic could ultimately be grown in Australia at 3.4 million hectares (2).

Paradana is the first variety of T. balansa and was released to seed producers in 1986. Although its area of potential use is more restricted than are the previously mentioned medic species, it has nevertheless been sown in many high rainfall areas of all southern States. The development and release of further varieties, especially varieties of different maturity will expand the area sown to this species (3).

A number of new varieties of serradella (O. compressus) have been released in the last five years and several more may be released in the next few years. The varieties are Tauro (1987), Avila (1987), Madeira (1988) and Elgara (1988). Varieties registered but not yet released are Paros and Eneabba.

Serradella sowings were previously confined to small areas of deep, acid sands in high rainfall areas. The new varieties allow expansion into broadacre farming situations in medium and possibly low rainfall areas and in the next few years a considerable expansion in the area sown is anticipated.

The release in 1989 of Kyambro a variety of Persian clover (T. resupinatum) more tolerant of grazing and harder seeded than the previously used variety Maral, is likely to result in an expansion in the area sown to this species (3). However, the species is best suited to neutral or alkaline heavy textured soils that may be waterlogged in winter and the area of these soils is limited in Australia.

Reasons for development of new species

A number of factors have been responsible for the recent proliferation of new species and markedly different new varieties of older species.

Soil Acidification

The majority of the agricultural soils of southern Australia are acid in reaction and are continuing to slowly acidify. The rate of acidification varies widely depending on soil characteristics, management, and fertilizer practices, but in many cases the pH has dropped substantially since clearing was undertaken (4). This trend has resulted in, and will continue to cause, replacement of species suited to neutral or alkaline soils with species more adapted to acid soils. For example the red brown earths of central New South Wales are in their native state pH 6.5-7.0 (1:5 soil:water) and were widely sown to barrel medic (M. truncatula) soon after clearing. Many of these soils have now acidified to pH 5.5-6.0 and nodulation failures of barrel medic are becoming much more common (5). Medics more tolerant of acid soils such as burr medic and murex medic are likely to provide a solution to this problem.

In some areas of southern Australia soil acidity is approaching the limit at which subterranean clover (T. subterraneum) productivity is threatened (6). The options are either liming of soils or increasing the use of legume species even more tolerant of acid soils such as serradella.

Unsuitable Species

In addition to increased acidification, there have been a number of other situations where existing species were poorly suited resulting in either poor productivity or persistence. These include hard setting soils reducing seed burial and seed set of subterranean clover; poor quality deep sands in dry areas where existing species failed to persist; frequent cropping resulting in lack of persistence of varieties with low hardseed levels and disease and insect susceptibility of existing species.

In these situations new species with different characteristics to existing species offered considerable gains **in** productivity. This has been the stimulus for the work on developing new species.

ROLES FOR NEW SPECIES

Burr medics

The particular characteristics of the recently released burr medics are an ability to persist on medium and heavy-textured soils of pH > 5.7, very high levels of hardseed, high seed yields and spineless pods. In addition the variety Serena is much earlier maturing than any other commercial medic variety.

These characteristics ensure that this species is well suited to mildly acid and neutral soils of the low and medium rainfall wheatbelt where cropping is frequent. They are ideally suited to 1:1 cropping rotations (1). Previously the only legume capable of growing on these soils was subterranean clover, but insufficient hardseed and low seed yield on the often hard setting soils generally resulted in poor persistence.

The burr medics are capable of setting large quantities of high quality pods if managed correctly. This can dramatically change the productivity of these pastures in summer and early autumn compared to the previous subterranean clover based pastures. The pod and seed component of dried burr medic pasture has a crude protein level of about 23% and a digestibility of about 56% (7). A high proportion of the diet of

sheep grazing these pastures is pod. Thus sheep can maintain weight well into summer and even early autumn providing sufficient quantity of pod is available.

Careful management of these pastures is required to avoid both excessive pod consumption resulting in poor regeneration, and in overgrazing leading to erosion. Stock condition will not be a good guide to carrying capacity as sheep will remain in good condition even when only fairly small quantities of pod are available. Cocks (8) working with mixtures of medics in Syria found that sheep could maintain bodyweight in summer until the level of seed reserves fell to 10 kg/ha. Although the levels of the smaller podded and less accessible burr medics are likely to be higher when bodyweight starts to fall, nevertheless a substantial proportion of the seed set is likely to be consumed by hard grazing. Cocks (8) measured seed consumption at 450 g/hd/day for mixed medic pods while Thorn (7) estimated seed consumption of burr medic to be about 300 g/hd/day. For six months summer grazing at 6 sheep/ha this would amount to 330-500 kg/ha of seed consumed.

About 25% of the ingested seed of the burr medics is excreted in faeces and could be available for subsequent germination (7), so it is unlikely that all the seed reserves can be removed by grazing animals. However considerable redistribution to sheep camps and watering points can be expected.

The development of spineless burr medic varieties has thus substantially changed the management options for farmers in medium and low rainfall areas on mildly acid soils. However, there seems little prospect for burr medic varieties to be developed for longer growing season areas as subterranean clover is well adapted to the soils and the longer rotations common in this region. The exception would be if varieties with greater productivity than subterranean clover could be developed.

Murex medic

Murex medic has several unique characteristics not possessed by other medics (9). In particular its ability to achieve satisfactory nodulation on soils as acid as pH 5.2 means that it can be grown on many soils where other medics fail and where subterranean clover is the only legume species considered suitable. However if the soils are hard setting or cropping is frequent, subterreanean clover often fails to persist.

Murex medic is also very tolerant of hard grazing while vegetative and responds similarly to subterranean clover (9). Weed control by hard grazing is thus far easier with murex medic than with other medics where hard grazing can have detrimental effects on subsequent seed yield.

Thirdly, murex medic has been shown to increase the period of green feed in late spring by approximately three weeks compared to other species of similar maturity (9). This has resulted in increased sheep body weights during summer as stock continue to gain weight in late spring for a longer period compared to sheep grazing dried residues of other species.

Although at this stage only one mid-season variety of murex medic has been released in Australia, several earlier maturing varieties are currently being evaluated and are likely to be released within 2-3 years. Their release will provide farmers with an alternative species to subterranean clover for use on soils that are too acid for other medics, but where subterranean clover has not persisted well due to either frequent cropping or hard setting soils.

Murex medic will provide similar advantages to that of the burr medics discussed above, namely the possibility of maintaining legume dominant pastures while cropping frequently, and also providing high quality summer and autumn feed for grazing animals.

Even more careful management of summer grazing is required for murex medic than is the case for the burr medics. The pod of murex medic is larger and more accessible to the grazing animal, and a much lower proportion of the seed passes through the animal due to a larger seed size. Although definitive seed passage studies have not yet been undertaken, preliminary work indicates that probably less than 5% of the seed of the variety Zodiac will pass through a sheep. Thus hard grazing over summer could

possibly eliminate Zodiac from a paddock, especially on hard setting soils where a high proportion of the pod is accessible. A recent experiment at Darkan (Western Australia) measured reductions in seed reserves from 690 kg/ha to 27 kg/ha when excessively high grazing pressure was applied to Zodiac on a hard setting soil. Reductions of this magnitude will seriously jeopardize the chance of successful pasture re-establishment. A solution to this would be to develop varieties with smaller pods and seeds that are consequently less susceptible to overgrazing mismanagement.

The advantages of providing high quality feed in late summer, hard grazing in winter with no adverse effects, extra duration of green feed in late spring, and few adverse effects of frequent cropping will ensure that murex medic will provide an attractive alternative to existing legume species once early maturing varieties become available.

Balansa clover

Paradana is the only variety of balansa clover released to date, but varieties with both earlier and later maturity are under test in South Australia and new varieties could be released in several years (3).

Balansa clover is characterized by small seeds (0.6-0.7 mg/seed) and seedlings hence winter production is often poor, especially in years with a late start to the season. Spring growth however is quite profilic and this, together with its erect growth habit, makes it ideal for hay production.

Balansa clover is suitable for a pH range of 5.5-7.5 and can tolerate moderate levels of winter waterlogging. In the south-east of South Australia, and in similar regions in Victoria and New South Wales, balansa clover is being used in permanent pastures in conjunction with waterlogging tolerant varieties of subterranean clover, such as Trikkala, to give increased stability and productivity to these pastures (3). In areas where subterranean clover has previously been unproductive, balansa clover may constitute as much as 90-95% of the legume component. In Western Australia balansa has mainly been used for increasing the productivity of run down pastures on acid sandy soils, mainly for hay cutting. The generally later start to the season in Western Australia together with often poorer soils may explain the poor winter production experienced with balansa clover in this State.

In contrast to burr medic and murex medic, balansa clover can be hard grazed during summer and autumn with no adverse effects on re-establishment density. The seeds are small and are only accessible to the grazing animal when still held in the erect seed heads in late spring. Even then most consumed seeds will pass through the animal undigested. Grazing management of balansa clover is thus simpler than that required for the medics.

The release of further varieties with different maturity to Paradana will expand the usefulness of this species but its relatively poor winter growth will continue to restrict its adoption unless more winter active varieties are identified. In many areas balansa clover's value as a hay crop will remain its most valuable characteristic.

Persian Clover

Until the release in 1989 of the variety Kyambro, the only variety of Persian clover available in Australia was the very late maturing, erect, soft seeded variety Maral. By contrast Kyambro is small leaved and more prostrate and tolerates grazing far better. It also has a reasonable proportion of hard seed, is 3-4 weeks earlier maturing, and is much more tolerant of rust (Uromyces trifolii) (3). Its persistence and productivity is expected to be markedly superior to that of Maral and considerable expansion in sowings of this species are therefore anticipated.

Persian clover is not suited to the major soil types present in Australia and so is unlikely to be sown over large areas. Nevertheless, the release of Kyambro is expected to result in a considerable increase in the area previously sown to this species. As is the case with balansa clover, Kyambro persian clover will

undoubtedly be used for both grazing situations and for hay production. Its hardseed level will ensure adequate natural regeneration without the need for reseeding.

Serradella

The role of serradella has previously been that of a legume for infertile deep sands in high rainfall areas where few other legumes were productive. In this situation the pastures were usually permanent pastures often with insufficient growth even for hay production. The release of varieties of earlier maturity, (e.g. Madeira and Elgara) and the likelihood of further releases of early maturing varieties has expanded both the potential area where serradella can be grown and the usefulness of the species.

In medium rainfall areas of northern New South Wales on acid soils no annual legume is currently adapted. The new serradella varieties Madeira and Elgara appear to be well suited and could soon be sown over large areas (10).

In Western Australia large areas of highly acid sandy soils in medium and low rainfall areas currently have no suitable pasture legume, although thin stands of subterranean clover can often be found on less acid sands that are not regularly cropped. The combination of early maturity, acid soil tolerance, deep rooting habit, and high levels of hard seed should enable the newly released serradella varieties to be both persistent and productive on these soils with regular cropping. Whether these varieties will be able to persist in longer rotations with infrequent cropping remains to be seen.

Although there are large potential gains to be made by using these new species and varieties, there are some problems that must be overcome before wide adoption will occur. The major problems with each species are:

- Burr medic - insect susceptibility, in particular bluegreen aphid (Acrythosiphon kondoi) and lucerne flea (Sminthurus viridis)
- Murex medic - redlegged earthmite (Halotydens destructor) (RLEM) susceptibility in flowering plants, excessive summer pod and seed consumption
- Balansa clover - RLEM susceptibility as a seedling, poor winter growth
- Persian clover - RLEM susceptibility as a seeedling
- Serradella - high cost of establishment with existing technology, efficient pod dehulling methods.

Conclusion

The development and release of several new species of pasture legumes in the last five years, together with the release of new varieties of several existing species, has significantly expanded the role of pasture legumes in southern Australia.

The development of spineless burr medic varieties and to an even greater extent the development of murex medic will significantly change the role of medics in Australian ley farming areas. These medics can now be grown on acid soils in close cropping rotations and can provide a source of high quality feed for grazing animals throughout summer in the form of pods.

Development of balansa clover together with major improvements in the variety characteristics of persian clover has provided a small seeded Trifolium variety for a wide range of soils of pH 5.5 and greater for permanent pastures in high rainfall areas. Because of their prolific spring production, these species are particularly valuable where high quality hay production is required.

The release of early maturing hard seeded serradella varieties has changed the traditional role for serradellas. Broadacre sowings on highly acid sandy soils in medium and low rainfall areas with the option of regular cropping is now a possibility.

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