

Biserrula

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Introduction

Biserrula (*Biserrula pelecinus*) is a self-regenerating annual legume. It is native to Mediterranean areas of Europe and Africa, the Canary Islands and highland areas of Kenya, Ethiopia and Eritrea. In its native environment, it is often found with other annual legumes, such as subterranean clover (*Trifolium subterraneum*) and serradella (*Ornithopus* spp.), growing on well-drained but relatively infertile, sandy, acid soils.

Germplasm was collected by Australian scientists from various regions of the Mediterranean basin, beginning in the late 1980s. This material was then further developed and evaluated, resulting in the release of the world's first commercially available cultivar of biserrula in 1997.

Adaptation

Biserrula has been successfully grown in areas receiving 390 mm average annual rainfall (AAR) in southern NSW, and 450 mm in northern NSW.

It can be used as a component of a permanent pasture mix in low, medium and high rainfall areas. In Western Australia, it has been successfully used in 1:1 cropping rotations (one year crop, one year pasture) in low and medium rainfall areas. The very high levels of hardseed mean that it is very well suited to this role. Biserrula seed softens in the cropping year, with seedlings emerging in the following year to provide high quality pasture. The nitrogen fixed by biserrula in the pasture year can then be used by the following crop. It is expected

that biserrula will be well suited to this role in low and medium rainfall cropping areas of NSW. It has also been used successfully in longer term pastures; however, due to a very high level of hardseed, it is important that biserrula residue be grazed intensively over summer, to increase the rate of hardseed breakdown.

Biserrula is adapted to well-drained soils with pH (CaCl₂) 4.2–7.0. It will also tolerate exchangeable aluminium levels up to 30%. However, biserrula is relatively intolerant of high levels of exchangeable manganese (Mn), which are commonly found in acidic soils, particularly in southern NSW. Biserrula does not tolerate waterlogging.

Description

Biserrula is a prostrate to semi-erect annual legume which can grow up to 50 cm tall. It has a longer period of active growth than some traditionally used pasture legumes, such as sub clover. Initially, this was thought to be due to a deeper root system which enabled it to access moisture from deeper in the soil profile; however, recent research (Fillery and Poulter 2006) has found that the soil water content at a depth greater than 0.5 m was the same under biserrula and subterranean clover pastures, indicating that there was little difference in rooting depth between the



Figure 1. Biserrula leaves and flower. Photo courtesy Department of Agriculture and Food Western Australia – Pasture Science Group.

two species.

Biserrula has a fern-like leaf with leaflets located opposite each other. Individual leaflets measure up to 10 mm long and 5 mm wide. Leaflets are indented at the tip (as opposed to serradella, which has a rounded tip). Flowers are small, and blue to mauve in colour.

The seed pod of biserrula is very distinctive, measuring up to 40 mm long and 10 mm wide. The edges of the seed pod are coarsely toothed, changing from green to brown with maturity. Each seed pod contains approximately 20 seeds, which are yellowish-brown. There are approximately 1,000,000 seeds/kg.

The hardseed level of biserrula is very high. This means that when false breaks (out-of-season rainfall without follow-up rain) occur, very little biserrula will germinate. Therefore, when a true autumn break does occur, little seed is lost from the soil seed bank, and regeneration is higher than for softer seeded species. When ingested by livestock, approximately 45% of seed survives passage through the gut.

Varieties

Casbah was developed by the Centre for Legumes in Mediterranean Agriculture (CLIMA) from material collected near Oued, Morocco by Dr P. Beale, Mr A. Lahlou and Dr M. Bounejmate in 1988. Casbah was released in 1997.

Casbah is an early to mid-maturing cultivar, flowering 100–105 days after a mid-May sowing in Perth, and approximately 115–120 days at Wagga Wagga and Tamworth. This makes it similar in maturity time to Dalkeith sub clover. Being the earliest maturing variety of biserrula with very high quantities of hard seed, Casbah is the most suitable biserrula variety to grow in areas where rainfall approaches the lower limit for successful



Figure 2. *Biserrula* pods and seed. Photo courtesy Department of Agriculture and Food Western Australia – Pasture Science Group.

biserrula growth. Furthermore, due to its very high hardseed levels, paddocks where Casbah is grown are best used in farming systems with intensive (1:1) crop/pasture rotations; that is, biserrula is sown in year 1, the paddock is then cropped in year 2 to allow sufficient biserrula seed to soften for regeneration in year 3, and then cropped again in year 4.

Mauro[®] was developed from material collected by Angelo Loi, Steve Carr and Claudio Cannas from the south-eastern region of Italy in 1995. This material was further developed and evaluated in the National Annual Pasture Legume Improvement Program under the code 95/LCP/16. Mauro[®] flowers about 10 days later than Casbah, and is best suited to areas receiving at least 450 mm AAR. Mauro[®] has slightly lower hardseed levels than Casbah, and therefore second year regeneration is better (Figure 3). Mauro can still be used in 1:1 cropping rotations, but is also more suitable than Casbah for use in permanent pasture areas or areas with less intensive cropping rotations.

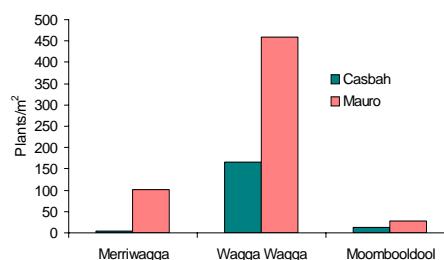


Figure 3. Second year regeneration of Casbah and Mauro[®] at three locations in southern NSW.

Establishment and management

Sowing

Paddocks in which biserrula is to be sown should be managed in preceding years to minimise weed and insect burdens. This strategy is not specific to biserrula, and should be used when considering sowing any pasture species. Biserrula can be sown into a conventional seed bed or direct drilled for good establishment.

Biserrula should be sown at rates of 1–4 kg/ha when used in mixtures with other legumes and grasses. If sowing as a monoculture for specific fodder conservation purposes, rates of 7–10 kg/ha should be used.

Seed should be sown no deeper than 20 mm into a moist seed bed. The optimum sowing time is mid to late autumn. If weed problems are anticipated, sowing should be delayed for several weeks following the autumn break, to allow weeds to

germinate and then be controlled with a 'knockdown' herbicide prior to sowing biserrula.

Inoculum

Biserrula requires specific rhizobia (Biserrula Special WSM 1497) for effective nodulation.

Fertiliser

Adequate phosphorus (P) is required to optimise legume growth. At least 10 kg P/ha should be used when sowing biserrula. Added sulphur (S) and trace elements such as molybdenum (Mo) may be required in some areas. Consult your local agronomist for further information.

Grazing

Care should be taken to avoid grazing biserrula too heavily during flowering and seed-set in the first year of sowing. This will allow biserrula to set large amounts of seed for regeneration in subsequent years.

In regenerating biserrula pastures, grazing can be maintained at moderate to high levels throughout the flowering and seed-set period. Research conducted in Western Australia (Loi et al. 2004) found that 400 kg seed/ha remained in a biserrula pasture where 35 sheep/ha had been grazed for a three-week period from mid-August until mid-September, followed by 12 sheep/ha from mid-October until mid-January.

If biserrula is to be used as a fodder conservation crop, grazing pressure should be removed by mid-August in low rainfall areas, or by mid-September in higher rainfall areas, to allow sufficient regrowth prior to harvesting

Hardseed

Both Casbah and Mauro[®] have very high levels of hardseed. Research conducted in Western Australia (Loi et al. 2006) found that Casbah and Mauro[®] were 99% and 94% hardseed, respectively, at harvest. By midwinter, this had fallen to an average of 86% and 72%, respectively. Therefore, seed should be scarified to ensure good germination in the first year.

Pests and diseases

Biserrula is susceptible to attack by red-legged earth mite, particularly at the early seedling stage. Practices to reduce the number of eggs laid by this pest in the years leading up to sowing should be followed where possible. Monitor pastures for signs of activity, and control if necessary.

Biserrula is also susceptible to attack by blue-green aphid and cowpea aphid. Monitor pastures for

signs of damage by these pests, and control if necessary.

Very few disease problems have been observed in biserrula.

Seed production

Biserrula is an aerial seeding legume capable of producing large quantities of seed. Research conducted in NSW has found that seed yields of 1000–1500 kg seed/ha are common. Biserrula can be harvested with a conventional cereal header.

Herbage production and nutritional quality

Herbage production

When grown as a regenerating pasture, biserrula is capable of moderate levels of herbage production. Generally, productivity in the second year will be lower than conventionally used legumes (such as sub clover) due to biserrula's high hardseed content. However, herbage production in subsequent years can often be better than conventional legumes, as the higher hardseed levels and resistance to false breaks allow biserrula to maintain higher plant density, and therefore higher growth.

The ability of biserrula to remain a productive component of a regenerating pasture is shown in Table 1 for a site at Moombooldool in southern NSW, where AAR is 460 mm. At this site, the production of biserrula was much greater than sub clover in year 1. In year 2, due to its high hardseed content, there was relatively low germination of biserrula, and hence herbage production was significantly less than that of the sub clover. There was good germination of biserrula in year 3, following softening of seed reserves, and productivity was moderate. In contrast, the soil seed bank reserve of sub clover had been depleted by false breaks in years 2 and 3. Accordingly, the number of sub clover plants present in year 3 was low, and this greatly reduced productivity.

Table 1. Herbage production (t DM/ha) over three years of Mauro[®] biserrula and Dalkeith subterranean clover at a site near Moombooldool in southern NSW.

	Year 1	Year 2	Year 3
Mauro [®]	9.1	0.7	2.2
Dalkeith	4.9	5.9	0.09

The problem of a low rate of hardseed breakdown following the first year of sowing can be alleviated to some extent by grazing biserrula intensively over summer. This will increase the percentage of seed

Table 2. Herbage production (t/ha) of several annual pasture legumes sown as a one year fodder conservation crop at various locations in NSW.

	Binalong	Harden	Berridale	Tamworth	Narrabri	Carroll	Warialda
Average annual rainfall (mm)	625	600	450	675	600	625	600
pH (CaCl ₂)	4.8	5.6	4.8	6.0	4.3	5.6	5.3
Exchangeable aluminium (%)	15	0	5	0	20	0	1
Soil type	Sandy loam	Red earth	Sandy loam	Medium brown clay	Sandy loam	Brown clay loam	Red basalt
Location ¹	sNSW	sNSW	sNSW	nNSW	nNSW	nNSW	nNSW
	Herbage production (t DM/ha)						
Casbah biserrula	13.1	6.6		4.2	3.0		3.2
Mauro ^{db} biserrula	13.7	7.1	2.3	5.8	2.3	3.1	
Margurita ^{db} French serradella	16.0	10.4		6.4	2.4	5.2	2.0
Paradana balansa clover	10.8	7.7	2.2	4.3			
Bolta ^{db} balansa clover	10.8	8.3					
Goulburn ^{db} sub clover	12.9	6.5	0.7				
Leura ^{db} sub clover	16.5	6.8	2.1				
Electra™ purple clover	16.0	14.0	2.9	10.3	2.8	6.8	2.4
Zulu arrowleaf clover	16.0	15.2	4.0	8.2	2.6	5.2	3.8

¹ refers to southern (s), central (c) or northern (n) NSW

ingested by animals. Approximately 45% of seed ingested by grazing livestock remains viable, and passage through the gut breaks down the seed coat, resulting in higher germination. However, before this strategy is imposed, the grazing requirements of other pasture components need to be considered, because close grazing over summer may be detrimental to the survival of companion pasture species, particularly perennial grasses. Contact your local agronomist for further information.

Biserrula may also be used as a specialist forage or fodder conservation crop. It has proven to be very highly productive in this role at many sites in NSW (Table 2).

Herbage quality

Herbage produced by biserrula can be of high quality, providing it is harvested at the correct time. Biserrula rapidly loses quality from the commencement of flowering through to maturity. Figure 4 shows the results of an experiment conducted at Cootamundra in southern NSW, where biserrula was sown as a one year fodder conservation crop. The quantity and quality of herbage on offer were analysed on five occasions through the spring-early summer period.

The results show that optimum herbage quality was recorded early in spring (11 October), prior to the commencement of flowering. Delaying harvest by six weeks (22 November) greatly increased the quantity of herbage available for fodder conservation, but quality – particularly digestibility – declined considerably. In deciding when to conserve fodder, producers need to consider not only the quantity of herbage available, but also its quality, because delaying harvest for too long to obtain a higher herbage yield will adversely affect quality, as well as the potential animal production that can be achieved from conserved fodder.

Photosensitisation

There have been some isolated cases of photosensitisation reported in sheep grazing biserrula pastures in Western Australia in recent years. The condition is not unique to biserrula, however, as many plants contain compounds that may cause photosensitisation. Once ingested, the compounds may be activated by sunlight in susceptible animals; if so, they will cause the skin to become sensitive to sunlight, with sunburn-like symptoms becoming visible around the eyes, muzzle and backline.

The number of sheep affected per mob has generally been very low. Most cases have been

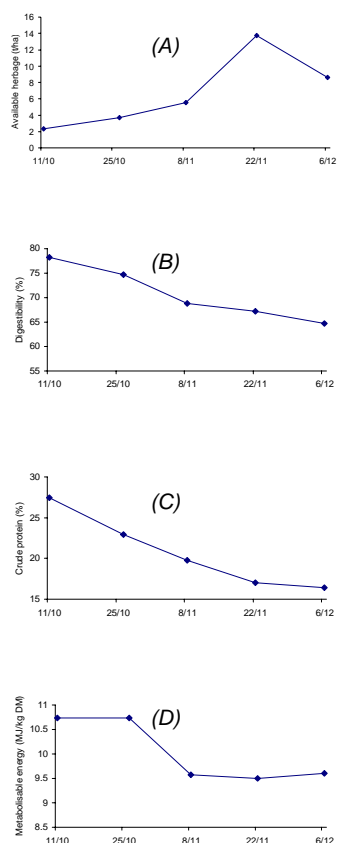


Figure 4. Herbage production (A), digestibility (B), crude protein (C) and metabolisable energy (D) of Casbah biserrula in uncut swards measured on five occasions through spring 2005 at Cootamundra NSW.

reported as occurring between August and October, the period in which pastures are growing most rapidly. Generally, it has only occurred in pastures dominated by biserrula, where there is little else for animals to graze.

Producers should regularly monitor sheep grazing biserrula, and watch for early indications of animals suffering from photosensitivity, such as animals seeking shade, and swelling of ears, eyelids and muzzle. Affected animals should be removed from the pasture immediately. In most cases, affected animals recover. It is advisable that producers avoid grazing lambs or freshly shorn sheep on biserrula-dominant pastures, as these animals are more exposed to sunlight, and the compounds causing photosensitisation may be more readily triggered.

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References and further reading

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Warnings

Pasture improvement may be associated with an increase in the incidence of certain livestock health disorders. Livestock and production losses from some disorders are possible. Management may need to be modified to minimise risk. Consult your veterinarian or adviser when planning pasture improvement.

Legislation covering conservation of native vegetation may regulate some pasture improvement practices where existing pasture contains native species. Inquire through your office of the Department of Natural Resources for further information.

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