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Mauro: a mid to late maturing cultivar of biserrula (*Biserrula pelecinus*)

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Abstract. Mauro is a new mid to late variety of biserrula. It was derived from a single plant selection from a population collected from a harsh and heavily grazed site in southern Sardinia, Italy. The later maturity, lower hard seed level and higher regeneration in the second year of Mauro compared with Casbah will enhance the performance of biserrula in areas with medium to high rainfall where permanent pasture or infrequent cropping are common.

Origin

Mauro is derived from a single plant selection from a population of *Biserrula pelecinus* L., which was collected by Drs Angelo Loi, Steve Carr and Claudio Porqueddu in 1995. The source population originated from Cantoniera Cannas (39°20′02″N, 9°25′45″E) in the south-eastern part of Sardinia (Italy) in 1995 (Loi *et al*. 1999*a*). The site was a sandy soil derived from granite with pH(H_2O) 7.0 and was at an altitude of 345 m. Estimated annual rainfall was 550 mm and the site was heavily grazed. This population was first evaluated along with other genotypes at the University of Western Australia Field Station in 1996. At the time it was noted that Mauro (LCP7/16) had superior agronomic characteristics compared with the other genotypes of *B. pelecinus* collected at the original site. For instance, Mauro had higher seed production (147 g/plant) compared with the rest of the population (120.2 g/plant). Multiplication of pedigree seed was conducted at Medina Research Station from 1997 to 2001. Mauro has been field-tested by the National Annual Pasture Legume Improvement Program (NAPLIP) under the code 95/LCP7/16 from 1999 to 2002. NAPLIP approved Mauro for commercialisation in 2002. The maturity and seed dormancy characters of Mauro have been maintained over several generations and at various locations. Mauro has been granted PBR registration (Loi 2005).

Morphological description

Mauro is an annual herb, with a prostrate growth habit, 25-cm tall, with lateral branches extending to 60 cm. Stems pilose, cross section hollow, slightly ribbed, light green with some red pigmentation. Leaves imparipinnate, 3 leaflets on the first leaf increasing to 23 leaflets at maturity. Leaflets elliptic-oblong, 7.2-mm long, 5.6-mm wide, base cuneate, apex retuse and pilose. Stipules: present, papery, ovate to lanceolate. Inflorescence: axillary raceme, peduncle shorter than subtending leaf, number of flowers per raceme 5. Flower: generally closed, corolla purple (RHS 76B). Calyx: 3-mm long, calyx segments 5, calyx segments similar to the tubes, light green or red pigmented, surface pilose. Pod: glabrous, brown, indehiscent, 28.1-mm long, 7.6-mm wide, oblong in longitudinal section, in transverse section flat with crest at each side which is coarsely toothed, number of seeds per pod 15. Seed: yellowish, deeply and narrowly notched at the hilum, weight 1.3 mg. Biserrula is a self-pollinated species ($2n = 16$) (Loi *et al*. 1997). Mauro flowers later than Casbah (115–120 and 100–105 in Perth, WA, respectively). Mauro's pods are shorter (28 mm) and contain 15 seed compared with those of Casbah which are 35-mm long and contains 20 seeds.

Agronomic performance

Mauro is a mid to late maturing cultivar, flowering about 115–120 days after emergence from a mid May sowing in Perth, Western Australia (31°20′S, 118°16′E). This is 15 days later than Casbah (Loi *et al*. 2001). It is suited to regions with 450–700 mm annual rainfall with a Mediterranean rainfall distribution pattern and can be grown as a companion plant with subterranean clover (*Trifolium subterraneum* L.) and yellow (*Ornithopus compresssus* L.) or hard seeded French serradella (*O. sativus* Brot.). Seed of biserrula must be inoculated with a unique inoculant for biserrula.

Agronomic evaluation of Mauro was conducted in NAPLIP at several sites in Western Australia and New South Wales between 1999 and 2001. The results suggest that Mauro will be suitable for use on acid and slightly alkaline loams in permanent pastures and ley or phase farming systems.

Field experimentation in Western Australia was conducted at Mingenew (400 km north-east of Perth, WA), Cunderdin (150 km east of Perth) and Pingelly (140 km south-east of Perth). The 3 sites have a typical Mediterranean climate with the Cunderdin and Mingenew sites having a fine textured soil, and pH(H_2O) of 6.2 and 5.8, respectively. The Pingelly site was sown on an acidic sandy-loam with a

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Table 1. Mean ± s.e. dry matter yield (DM) and seed yield (SY) ± s.e. in the year of establishment (1998) and dry matter yield after a crop (2000) at 2 sites in Western Australia

Cultivar	Cunderdin, WA			Mingenew, WA		Flowering time in
	DM98 (t/ha)	DM00 (t/ha)	SY98 (t/ha)	DM98 (t/ha)	SY98 (t/ha)	Perth, WA (days)
Mauro	4.3 ± 0.8	5.1 ± 0.4	374 ± 19	4.4 ± 0.3	219 ± 87	116
Casbah	4.3 ± 0.3	5.5 ± 0.7	439 ± 148	4.8 ± 1.3	568 ± 224	105

Table 2. Dry matter yield (DM) and seed yield (SY) in the year of establishment (1999) at 1 site in Western Australia and at 3 sites in New South Wales

Cultivar	Pingelly, WA		Merriwagga, NSW		WaggaWagga, NSW		Moombooldool, NSW	
	DM99 (t/ha)	SY99 (t/ha)	DM99 (t/ha)	SY99 (t/ha)	DM99 (t/ha)	SY99 (t/ha)	DM99 (t/ha)	SY99 (t/ha)
Mauro	3.7	780	4.9	1139	8.8	1587	9.1	1351
Casbah	3.8	916	7.1	786	8.7	1194	9.1	939
l.s.d. ($P = 0.05$)	1.2	405	1.3	260	1.1	423	0.3	706

pH(H_2O) of 5.0. The average annual rainfall for the sites is 365 mm, 370 mm and 440 mm respectively, with a shorter and warmer growing season for the Mingenew site. The average daily minimum for the Western Australian sites in July ranges from 5.2 to 6.2°C while the average daily maximum for January ranges from 32 to 36°C.

The New South Wales experiments were established in 1999 at Merriwagga [pH($CaCl_2$) 5.2, pH(H_2O) 6.1] and Moombooldool [pH($CaCl_2$) 4.6, pH(H_2O) 5.8] on a red earth and at Wagga Wagga on a red-brown earth [pH($CaCl_2$) 4.3, pH(H_2O) 5.2]. Merriwagga was the lowest rainfall site receiving 390 mm per annum with the highest rainfall month being October (40 mm) and the lowest December (28 mm) with all other months receiving rainfall amounts between these levels. Although rainfall distribution is non-seasonal, very high evaporative loads in late spring, summer and early autumn result in Mediterranean like soil moisture conditions. The Moombooldool site has an average annual rainfall of 460 mm with a high of 45 mm in October and a low of 34 mm in December. Wagga Wagga was the highest rainfall site receiving an annual average rainfall of 670 mm with a high of 67 mm in October and low of 38 mm in December.

Dry matter yields in spring of ungrazed Mauro in Western Australia ranged from 3.7 to 5.1 t/ha (Tables 1 and 2), and from 4.9 to 9.1 t/ha in New South Wales (Table 2). Dry matter yield and seed yield in NSW clearly indicated that Mauro was well suited to the higher rainfall Wagga Wagga site. Mauro performed well at the lower rainfall sites but did not out perform Casbah at these sites. Mauro remains green longer than Dalkeith subterranean clovers owing to its deeper root system. Seed yields of Mauro ranged from 0.4 to 1.6 t/ha (Tables 1 and 2) and observations indicate adequate seed production under grazing. Mauro has consistently produced higher seed yields than Herald strand medic (*Medicago littoralis* Rhode) and Dalkeith subterranean

Table 3. Mean ± s.e. seedling regeneration (plants/m^2) in the second year (1999) and after a crop (2000) at 2 sites in Western Australia

Cultivar	Cunderdin, WA					Mingenew, WA	
	1.iv.1999	28.v.1999	2.ii.2000	10.v.2000	7.iv.1999	27.v.1999	19.iv.2000
Mauro	1179 ± 266	663 ± 22	1175 ± 165	319 ± 168	195 ± 77	92 ± 93	383 ± 32
Casbah	22 ± 2	396 ± 33	419 ± 161	333 ± 47	25 ± 7	37 ± 6	317 ± 31

Table 4. Seedling regeneration (plants/m^2) in second year (2000) and third year (2001) at 1 site in Western Australia and at 3 sites in New South Wales

Cultivar	Pingelly, WA 30.x.2000	Pingelly, WA 24.x.2001	Merriwagga, NSW 27.iv.2000	WaggaWagga, NSW 27.iv.2000	Moombooldool, NSW 3.iv.2000
Mauro	283	4600	101	460	28
Casbah	64	4733	5	167	14
l.s.d. ($P = 0.05$)	109	1900	164	224	70

Table 5. Seed softening (% hard seed) of biserrula in the field over 1 summer at Perth, Western Australia (initial test January 1999, final test July 1999)

Newly ripened seed was collected from 2 sites in Western Australia in December 1998. Values are mean ± s.e.

Cultivar	Cunderdin Jan. 1999	Cunderdin July 1999	Pingelly Jan. 1999	Pingelly July 1999
Mauro	94 ± 1.0	69 ± 8.1	95 ± 3.1	75 ± 0.8
Casbah	99 ± 0.2	86 ± 5.4	96 ± 0.8	87 ± 2.8

clover and out yielded Casbah at the high rainfall sites. Mauro has very good quality forage in terms of dry matter digestibility (77%), metabolisable energy (11 MJ/kg DM) and crude protein generally varies between 25 and 32% at the start of flowering.

In Western Australia seedling regeneration of Mauro in the second year was consistently higher than the earlier maturing cultivar Casbah (Tables 3 and 4), which supports hard seed studies (Loi *et al*. 1999b) indicating levels for Mauro (69–75% hard seed in winter) are lower than those for Casbah (86–87% hard seed in winter) (Table 5). Hardseededness of Mauro is still sufficient to allow its persistence after occasional cropping rotations (Table 3).

There is exciting potential for the use of biserrula in southern Australian farming systems. The later maturity and more rapid seed softening of Mauro compared with Casbah will enhance the performance of biserrula in areas with medium to high rainfall where permanent pasture or infrequent cropping are common. Apart from Australia, countries such Italy (Sardinia), Portugal, Spain, South Africa and Chile will benefit from Mauro considering that most of their animal production is based on permanent pastures in medium to high rainfall environments. These conditions are best suited to relatively soft seeded, late flowering species.

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