

# Evaluation of perennial forage legumes on Eyre Peninsula

RESEARCH

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## Key messages

27 months after establishment the study has continued to show:

- Lucerne to be well adapted to good Eyre Peninsula cropping soils.
- Cullen and Tедера to be more persistent and productive than lucerne on shallow calcareous and highly acidic soils respectively.
- Sulla to be highly productive on good EP cropping soils in the growing season following establishment.

## Why do the trial?

The use of perennial legumes on Eyre Peninsula has been largely restricted to lucerne, however it is not considered to be well adapted to shallow constrained soils common across much of the region. The benefits of a perennial legume phase within an intensive cropping system for soil rehabilitation and economic weed

management is well documented.

As part of a national program to identify alternative perennial legumes to lucerne suitable for incorporation within cropping systems, there are at least 3 options potentially adapted to specific areas and systems within Eyre Peninsula.

Research in South Australia has shown Sulla (*Hedysarum coronarium*) to be a highly productive, perennial/biennial legume. The plants can survive for 2-3 years, but it will regenerate readily from seed. Sulla is used for grazing or hay production and contains condensed tannins that make it bloat-safe, increase protein digestion in livestock and make it less attractive to insects. These tannins also provide a reputed anthelmintic effect which may reduce worm and nematode burdens. Sheep grazing Sulla have been recorded to scour less, which is considered a result of the tannin content.

Western Australian research is suggesting that *Bituminaria bituminosa var albomarginata*, or Tедера, as it is more commonly known in its native Canary Islands, has the potential to offer a solution to the shortcomings of lucerne. It is shallow-rooted and very drought tolerant. Lucerne may only survive summer drought by its deep roots accessing a water supply. On

many EP soils lucerne dies in the more constrained, shallow soils.

The third option *Cullen australasicum*, a native perennial legume, has been as persistent and productive as lucerne in previous South Australian studies. These results suggest that Cullen species will have adaptations to both survival and productivity traits that make them suitable for further development as perennial pastures in the low rainfall Mediterranean climate of upper Eyre Peninsula.

These three perennial species were considered worthy of continuing evaluation to compare to lucerne at a range of Eyre Peninsula sites. To review 2010 results see EPFS Summary 2010, p 141.

## How was it done?

Six lines of forage perennials: Lucerne, Sulla, Cullen and three Tедера lines were established at four Eyre Peninsula sites in 2010 to represent four rainfall and soil type regions: Minnipa (325 mm), Rudall (350 mm), Edillilie (400 mm) and Greenpatch (450 mm). Soil types varied from red sandy loam (Minnipa, pH 7.7-7.8 CaCl<sub>2</sub>), calcareous sand (Rudall, pH 7.7-8.1 CaCl<sub>2</sub>), slightly acidic, shallow duplex (Edillilie, pH 6.4-7.5 CaCl<sub>2</sub>) and an acidic sand over clay (Greenpatch, pH 4-5.1 CaCl<sub>2</sub>) in the 0-0.6 m soil profile.

Table 1 Plant establishment and persistence (plants/m<sup>2</sup>) from 2010 (Minnipa 2011) until 2012

	Minnipa		Rudall		Edillilie		Greenpatch	
	2011	2012	2010	2012	2010	2012	2010	2012
Tедера 27	17	16	5	5	9	6	9	7
Tедера 37	13	13	4	3	5	4	8	6
Tедера 42	11	12	4	8	6	6	7	8
Lucerne	17	17	3	2	8	5	6	3
Cullen	40	18	7	6	5	3	18	3
Sulla			4	1	21	2	17	4

**Table 2 Total 2010 to 2012 (Minnipa 2011-2012) May to October and November to April biomass production (tDM/ha) at the 4 evaluation sites**

	Minnipa		Rudall		Edillilie		Greenpatch	
	Nov - Apr	May - Oct	Nov - Apr	May - Oct	Nov - Apr	May - Oct	Nov - Apr	May - Oct
Tedera 27	0.7	2.4	0.31	0.25	1.7	3.2	0.63	1.42
Tedera 37	0.5	1.0	0.13	0.10	1.3	2.5	0.10	0.45
Tedera 42	0.6	2.2	0.29	0.24	1.5	3.4	0.49	0.86
Lucerne	1.4	4.9	0.44	0.10	3.9	2.4	0.33	0.27
Cullen	0.7	2.8	0.43	0.44	2.1	2.9	0.10	0.45
Sulla			0.27	0.10	1.7	5.5	0.10	0.39

**Table 3 November 2011 and April and November 2012 volumetric soil water contents (mm) at Edillilie**

	November 2011	April 2012	November 2012
	0-60 cm		
Tedera 27	131	186	118
Tedera 37	143	183	123
Tedera 42	143	167	122
Lucerene	126	188	125
Cullen	149	173	130
Sulla	141	175	113

In 2010 the trials were hand sown in 3 x 2 m plots replicated twice: Minnipa 2 June, Edillilie 22 July, Rudall 30 July, then re-sown on 18 September and Greenpatch 11 October. The Minnipa site was desiccated with an unplanned broad spectrum herbicide in March 2011. A replacement site was established at Minnipa on 2 May 2011, 5 x 1.5 m plots with 2 replicates were hand-sown into rows at 0.5 m row spacings.

### What happened?

The trials were measured for biomass and plant numbers at each flowering time. 2012 rainfall and the months sampling was carried out in 2012 were; Minnipa (237 mm, January, May, July and October), Rudall (320 mm, January, April and May then site abandoned), Edillilie (385 mm, January, February, April, May, July, October, November and December) and Greenpatch (450 mm, January, April and May then site abandoned). Soil water measurements were collected in November 2012 at the Edillilie site to compare water use of species being evaluated.

The Sulla plant densities had declined after 2 summers at all 3 sites (Table 1). Cullen numbers declined at both the higher rainfall

neutral to acidic Greenpatch and Edillilie sites, and reduced numbers at the Minnipa site in line with other entries. Lucerne plant numbers have trended lower at the 3 initial sites. The Tedera 27 and 37 have similar to lower numbers at all 4 sites while Tedera 42 has maintained or increased numbers over the 18 and 30 month period.

Over the study period the entries that produced more biomass than the site mean, the average of all entries, were lucerne at Minnipa, Cullen and Tedera lines 27 and 42 at Rudall, Lucerne and Sulla at Edillilie and Tedera lines 27 and 42 at Greenpatch (Table 2). Tedera line 37 produced less than the site mean at all 4 sites.

Soil water content at Edillilie declined over the 12 months under all the entries apart from lucerne (Table 3), which returned to the 2011 figure.

The abandonment of the Rudall and Greenpatch sites in May 2012 was in response to the Cullen (Rudall) and Tedera (Rudall and Greenpatch) having shown their improved adaptation in terms of productivity and persistence to these constrained sites compared to lucerne with low productivity and plant numbers supporting the

decision. The continuation of the 2 sites on the “better” cropping soils until April 2013 will assess the drought tolerance of these lines over the third and to date driest summer period of the study.

### What does it mean?

Both the Tedera and Cullen are only partially developed lines and will continue to be progressed through an intensive selection process in terms of establishment, management, persistence and animal production issues. However, these trials are giving an indication as to the potential role of “improved” lines of these perennial pasture species in the EP environment and farming systems.

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