DRYLAND LEGUME PASTURE SYSTEMS: LEGUME ADAPTATION

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TAKE HOME MESSAGES

- Margurita French serradella was the standout alternative pasture legume for biomass production.
- Other performers included Bartolo bladder clover, SARDI rose clover, PM250 strand medic and Studenica vetch. A mix of Studenica vetch with Sultan SU medic also did well.
- Most legumes produced a large number of seeds, >5000/m^2.

BACKGROUND

An aim of the Dryland Legume Pasture Systems (DLPS) project is to provide a critical assessment of the regional performance of commonly grown legumes (medics and vetch) and recently developed pasture legumes, such as serradella, biserrula and bladder clover. This assessment includes the measurement of their impact on crop production, farm profit and financial risk.

Legume pastures have been beneficial for low to medium rainfall farming systems, providing valuable livestock feed, a disease break for cereal root diseases, and nitrogen (N) fixation. Over the past three decades there has been a shift from integrated crop-livestock production to more intensive cropping. Intensive cropping is prone to herbicide resistant weeds, large nitrogen fertiliser requirements and major financial shocks due to frost, drought or low grain prices. Coupled with periods of drought, this has significantly eroded seedbanks of legume pastures for many farms. Despite a continuing positive outlook for livestock and legume pasture benefits, pasture renovation rates remain low. The opportunity exists to improve the quality of the pasture base on many low to medium rainfall mixed farms across southern Australia.

AIM

To evaluate the establishment, production and persistence of a range of pasture legumes grown on sandy Southern Mallee soils.

PADDOCK DETAILS

Location:	Jil Jil
Crop year rainfall (Nov-Oct):	376mm
GSR (Apr-Oct):	181mm
Soil type:	Sand
pH:	0-10cm: 6.8, 10-40cm: 8.0, 40-70cm: 8.5, 70-100cm: 8.6
Paddock history:	Cereal

TRIAL DETAILS

Crop type:	Legume pastures
Treatments:	Refer to Table 1
Seeding equipment:	Knife points, press wheels, 30cm row spacing
Sowing date:	17 May 2019
Replicates:	Three

TRIAL INPUTS

Fertiliser:	Granulock® Supreme Z + Flutriafol (200mL/100kg) @ 60kg/ha at sowing
Herbicide:	17 May – Roundup® @ 2L/ha applied IBS
	20 June – Liase @ 2% + Haloxyfop @ 0.075L/ha + Clethodim @ 0.3L/ha + Uptake @ 0.5%
	26 July – Liase @ 2% + Haloxyfop @ 0.075L/ha + Clethodim @ 0.3L/ha + Uptake @ 0.5%

Weeds, pests and disease were controlled according to best management practice.

METHOD

A replicated field trial was sown using a complete randomised block design on a deep sandy soil. Pasture variety descriptions and sowing rates are given in Table 1. Assessments included establishment counts, biomass production at flowering and seed production. The biomass samples were used to estimate feed quality and N fixation. Feed quality and N fixation data was not available at the time of writing.

Table 1. DLPS Trial treatment outline, Jil Jil, 2019.

Variety	Description notes*	Sowing rate (kg/ha)
SARDI rose clover	Developed in upper mid-north SA, not widely sown in Mallee but reports of good performance	7.5
Bartolo bladder clover	WA cultivar, aerial seeded, limited testing in the southern region	7.5
Cefalu arrowleaf clover	Deep rooted, adapted to deep well-drained soils	5.0
PM250 strand medic	Powdery mildew resistant, tolerant of SU herbicide residues, developed for SA Mallee regions. Scheduled for release 2021	7.5
Sultan SU barrel medic	Tolerant of SU herbicide residues	10.0, 5.0, 2.5 (3 treatments)
Toreador hybrid disc medic	Developed for sandy soils	7.5
Boron burr medic	Boron tolerant breeding line, spineless	7.5
Astragalus	Australian Pasture Genebank selection, new rhizobia	10.0
Casbah biserrula	WA cultivar, limited testing in the southern region	5.0
Margurita French serradella	WA cultivar, suited to acid soils	7.5
Trigonella balansae 5045	New species, aerial seeded	5.0
Studenica common vetch	New vetch, specifically developed for drier areas	40.0
Morava common vetch	Old cultivar	40.0
Studenica vetch x Sultan SU medic	Mix of 2 pasture species	10.0 of each

*Notes adapted from Tomney F. *et al*., 2019

RESULTS AND INTERPRETATION

While there was little rainfall in the first four months of 2019, Jil Jil received 172mm of rain in December 2018, and 48mm during May in the lead up to sowing. Growing season rainfall was average in the winter months, but the spring finish was dry.

All legume pasture lines established, with plant counts ranging from 25 to 140 plants/m^2 (Table 2).

Table 2. Average establishment (plants/m^2), flowering biomass (t/ha) and final seed set (seeds/m^2). Letters indicate significant difference.

Treatment	Establishment (plants/m^2)	Flowering biomass (t/ha)	Seed set (seeds/m^2)
SARDI rose clover	116^{cde}	1.09^{ab}	12649^{d}
Bartolo bladder clover	132de	1.30^{ab}	13125^{d}
Cefalu arrowleaf clover	157^{e}	0.80^{ab}	6726^{abcd}
PM250 strand medic	95^{bcd}	1.04^{ab}	10396^{cd}
Sultan SU barrel medic @ 10kg	104^{bcde}	0.65^{a}	4569^{abc}
Sultan SU barrel medic @ 5kg	70^{abc}	0.65^{a}	5326^{abc}
Sultan SU barrel medic @2.5kg	25^{a}	0.53^{a}	2204^{ab}
Toreador disc medic	54^{ab}	0.55^{a}	3338^{ab}
Boron burr medic	105^{bcde}	0.69^{ab}	4455^{abc}
Astragalus	126de	0.50^{a}	9944^{cd}
Casbah biserrula	55^{ab}	0.78^{ab}	27252^{e}
Margurita French serradella	140de	2.09^{b}	29739^{e}
Trigonella balansae 5045	119^{cde}	0.40^{a}	3320^{ab}
Studenica common vetch	60^{ab}	1.25^{ab}	1377^{ab}
Morava common vetch	67^{abc}	0.68^{ab}	130^{a}
Studenica vetch x Sultan SU medic	104^{bcde}	1.17^{ab}	5415^{abc}
Sig. diff.	**<0.001**	**0.007**	**<0.001**
LSD (P=0.05)	**28.39**	**0.73**	**6844**
CV%	**17.8**	**49.5**	**46.9**

Pasture production in general was low in the establishment year, with biomass at flowering ranging from 0.4t/ha by Trigonella balansae, to 2.1t/ha by Margurita French serradella. SARDI rose clover, Bartolo bladder clover, PM250 strand medic and Studenica vetch produced from 1t/ha to 1.4t/ha. The mix of Studenica vetch and Sultan SU medic also produced more than 1t/ha of biomass (Table 2).

There was no relationship between plant number and biomass production. This indicates that in some species, Astragalus and Trigonella in particular, poor performance was not due to low numbers.

It is important to note there was significant grazing by wildlife at the site that impacted final biomass and seed pod counts. The paddock around the trial was sown to taller growing canola, making the lower legume pastures attractive to forage later in the season. Other cereal-legume mix pastures sown on the farm produced more than 5t/ha biomass – higher than expected from a pure legume pasture stand, but demonstrating it was a favourable season for pasture growth and that grazing losses in the trial may have been substantial.

Most legumes produced a large number of seeds (>5000/m^2) indicating flowering time was early enough for the environment and that a good seedbank has been established. The trial will be oversown with Scope barley in 2020, then allowed to regenerate as a pasture again in 2021. This will allow for assessment of persistence and performance of these pastures within a cropping rotation.

COMMERCIAL PRACTICE

The successful introduction of new legume pasture types will depend on their adaptation to soil texture and pH, and having a flowering time appropriate to the growing season rainfall. Other main features for success include the ability to establish, suitable hard seed levels for regeneration, seed harvestability to reduce establishment costs, ability to be dry sown, tolerance to herbicides and the ability to grow useful biomass for grazing and groundcover.

A systems approach is needed to nurture seedbanks and allow persistence in a rotation.

REFERENCES

Tomney F., Ballard R., Peck D., Hill J., Richter I., and Scholz N., 2019, *Eyre Peninsula Farming Systems 2018 Summary*, 'Dryland Legume Pasture Systems: Legume adaptation' pp 153- 158. https://eparf.com.au/research-project/ep-farming-systems-summary-2018/

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