Establishing and managing perennial phase pastures

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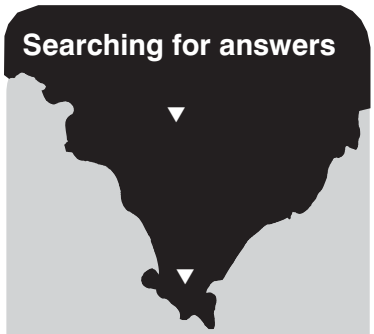
RESEARCH



Location:
Edillilie, Peter Treloar
Minnipa, Minnipa Ag Centre
Rainfall
Edillilie
Av. Annual: 490 mm
Av. GSR: 397 mm
2012 Total: 381 mm
2012 GSR: 333 mm
Minnipa
Av. Annual: 325 mm
Av. GSR: 397 mm
2012 Total: 253 mm
2012 GSR: 185 mm
Soil Type
Edillilie: Duplex gravel sand over clay
MAC: Red calcareous sandy loam
Plot Size
Edillilie: 5m x 2m x 3 reps
MAC N4: 10 ha
MAC Argonomy: 20 m x 2 m x 2 reps
MAC Enrich: 185 m x 40 m

Key messages

- **Under-sowing perennial legumes to barley failed in 2012.**
- **Over-cropping established lucerne with a cereal produced a viable crop yield but suppressed lucerne to the extent the population declined.**

Why do the trial?

The introduction and use of perennial legume pastures on Eyre Peninsula is often restricted by shallow constrained soils, not suitable for deep rooted perennials. The project "Evaluation of perennial forage legumes on Eyre Peninsula" outlined in the 2012 EP Farming Systems Summary aimed at identifying and promoting perennial options for these constrained soils.

However there may also be a role for perennials as phase pastures in cropping systems to address weed, pest and disease issues that require an extended break. Phase pastures can be described as pastures that require establishment at the commencement of each phase, as opposed to a self-regenerating annual medic pasture.

The trials reported are based on evaluating opportunities to integrate well adapted perennial legumes into cropping rotations as breaks between extended periods of cropping. Lucerne due to its partial winter dormancy and summer activity is one option. Sulla as a second option has performed well in current trials (EPFS Summary 2012, Evaluation of perennial forage legumes on Eyre Peninsula), and differs from lucerne in that it is a biennial and summer dormant.

The time required for successful establishment of the perennial is an issue whereby a full season's production can be lost before any grazing can be undertaken. An option to address this is to under-sow the final year of the cropping phase with the perennial. An establishment trial was established at Edillilie and a commercial demonstration site on Minnipa Agricultural Centre (MAC) to assess under-sowing lucerne and other alternative perennials.

The other component evaluated was the over-cropping of established lucerne pastures with a cereal crop to assess the opportunity to produce an economic field crop while producing high quality stubbles and a summer forage supply. This addresses the ongoing cost and risk of failure when establishing a perennial. A trial and a demonstration site were established at Minnipa in 2012.

How was it done?

Under-sowing perennials

At Edillilie lucerne, Sulla, Cullen and Tedera were sown on 7 June 2012 both as monocultures and in alternate rows with Hindmarsh barley crop sown @ 60 kg/ha and 30 kg/ha in 6, 0.25 m and 3, 0.5 m spaced rows respectively by 5 m plots. All plants within plots were counted on 14 September and again on 5 December. Total plot biomass samples were collected on 19 October and 5 December. Grain yield comparisons between the 6 and 3 row barley plots were estimated from biomass collected at anthesis (19 October) and calculated from harvest indexes. Due to bird damage it was not possible to harvest complete plots. Comparative soil water contents in the 0-20, 20-40 and 40-60 cm profiles were collected on 20 November.

A demonstration site on MAC in paddock North 4 was sown on 6 June with Hindmarsh barley @ 35 kg/ha with 60 kg/ha of DAP at 30 cm row spacing. Lucerne (SARDI 10) was then sown @ 2.5 kg/ha in the inter-row, with no further fertiliser applied. Plant establishment counts were collected on 26 November, 8 December and 8 January from 100 1 m x 0.6 m quadrants.

Over-cropping established lucerne

At MAC in the agronomy paddock, lucerne was established in June 2011 in 20 m x 6 row plots, sown with GPS guided 2 cm auto steer. In 2012 sown rows of lucerne were removed with broad spectrum herbicides to allow for 5 sowing configurations (Table 1). On 24 May 2012 wheat was sown with 60 kg of DAP and at a sowing rate representative of the number of rows sown, 60 kg/ha 6 rows, 30 kg/ha 3 rows etc. On 9 July Bromoxyil and Hoegrass® was applied for broad-leaved weed and annual ryegrass control, it also suppressed lucerne production over winter. Measurements taken included soil water content pre-seeding, 19 April, and post harvest, 30 October, in 0.3 m soil profile sections down to 0.9 m, lucerne plant numbers on 4 June and again with biomass sampling on 29 October, from the complete plot. The wheat grain yield was calculated from plot weights collected with a Kingaroy harvester on 29 October.

An over-cropping demonstration site was established at MAC in the Enrich paddock on 24 May 2012 when a 1 ha paddock of lucerne sown in 2009 had wheat and DAP both @ 60 kg/ha sown into half the paddock. Comparative biomass and lucerne plant numbers between treatments were estimated.

What happened?

Winter rainfall at Edillilie in 2012 was average (150 mm) but below average in spring (50 mm). At Minnipa it was similar, average over winter (100 mm) and low in spring (24 mm).

Table 1 Lucerne (L) and 2012 wheat (W) sowing configurations at Minnipa, 2012

Treatment 1	Treatment 2	Treatment 3	Treatment 4	Treatment 5
LLLLLL	LWLWLW	LWWLWW	LWWWWL	WWWWWW

Table 2 Plant numbers (plants/m^2), total biomass (tDM/ha), grain yield (t/ha) and soil water content (mm/0-0.6 m) at Edillilie in 2012

Treatment		Plant numbers (plants/m^2)		Total biomass (tDM/ha)	Grain yield (t/ha)	Soil water content (mm/0.06 m)
Plant type	Sowing configuration	14 Sept	5 Dec	5 Dec	5 Dec	22 Nov
Cereal	Monoculture				1.3	101
Lucerne	Monoculture	16	12	0.48		108
Lucerne	Alternate rows	8	2	0.01	0.8	94
Tedera	Monoculture	15	9	0.17		96
Tedera	Alternate rows	6	2	0.01	0.9	95
Cullen	Monoculture	13	6	0.02		101
Cullen	Alternate rows	5	1	0.00	0.9	119
Sulla	Monoculture	11	7	0.45		99
Sulla	Alternate rows	6	1	0.01	0.9	88

Table 3 Lucerne (L) plant numbers (plants/m2), total biomass (tDM/ha), wheat (W) grain yield (t/ha) and soil water content (mm/0-0.09 m) in the over-cropping trial at Minnipa, 2012

Treatment	Plant numbers (plants/m^2)		Total biomass (tDM/ha)	Grain yield (t/ha)	Soil water content (mm/0.06 m)
Row configuration	4 June	29 October	29 October		
WWWWWW				2.6	100
LWLWLW	3	0.5	0.02	1.9	98
LWWWWL	4	1.7	0.07	1.7	98
LWWLWW	4	0.8	0.04	2.0	98
LLLLLL	11	8.5	1.40		96

Established perennial legume numbers at the Edillilie site (Table 2) correlated with the 2 sowing densities; however number declined more in the alternate row sowing treatments than the monoculture. Biomass figures reflected the poor growth in the alternate row treatments plus the poor adaptation of the Cullen to the site. Estimated barley grain yields reflected the wide alternate row spacing. Soil water contents measured on the 22 November were variable, they trended higher under the monocultures but were much higher than prior to sowing when a site average of 62 mm was measured.

Lucerne densities in the North 4 demonstration site at Minnipa were counted 3 times to measure any decline. The barley yielded 1.4 t/ha. Counts on the 26 November, 20 December and 8 January 2013 totalled 9, 6 and 3 lucerne plants/ m^2 respectively.

Over-cropping established lucerne with wheat in the agronomy paddock resulted in the loss of lucerne plant numbers and the suppression of lucerne biomass production (Table 3). The wheat yields reflected both the number of crop rows in each treatment plus the edge effect of the LWLWLW configuration compared to LWWWWL. Soil water content at the commencement of the study was 101 mm/0-0.9 m soil profile.

The over-cropping demonstration site in the Enrich paddock established 21 plants/m^2 in 2009 and produced 10 t DM/ha from November 2010 to January 2012. On 20 August 2012 the wheat lucerne mixture had produced a total of 2.1 t/ha dry matter (wheat 1.2 t/ha, lucerne 0.9 t/ha), the lucerne monoculture 1.9 t/ha (lucerne 1.3 t/ha, weeds 0.6 t/ha) from 16 and 13 plants/m^2 respectively.

What does it mean?

The dry spring conditions may have contributed to the failure to establish perennials under a barley crop at Edillilie due to an increased competition for soil water between an established annual crop and an establishing perennial; however the trial gave no such indication. There was a similar amount of water under the under-sown plots in the 0-0.6 m soil profile or within the 0.2 m profile subsections as the monocultures, plus the soil water contents were all much higher than the pre-seeding site average, thus there was no deficit. Crop nutrients were applied similarly to all treatments therefore the most likely conclusion is one of shading to explain the increased decline in plant numbers in the under-sown treatments. The under-sowing demonstration at Minnipa was considered a failure as a decline from 9 to 3 plants/m^2 by early January and an expected further decline prior to the seasonal break, is unlikely to constitute a productive pasture component.

The over-cropping trial showed the capacity of the wheat, with the addition of registered herbicide treatments, to suppress lucerne to the extent where the population declined. There was no major addition or decline in soil water contents measured at harvest between the wheat and lucerne monocultures in response to average winter rainfall. This suggests that the site provided no deeper access to the perennials over the course of the study than the cereal, which followed a lucerne stand that would have the soil water profile near to plant lower limits. Any further work should be undertaken on a deeper soil type. The demonstration showed some potential to increase production from a lucerne stand, plus compete with weeds volunteering into a monoculture, through sowing a cereal crop into the lucerne inter-row. It may also improve subsequent lucerne productivity by lightly cultivating the soil and applying fertiliser for both an immediate and long term production benefit.

Acknowledgements

Thanks to Terry Blacker, Ian Richter and Wade Shepperd for technical and operational support, Peter Treloar at Edillilie for allowing the use of the land for the trial.