Dry matter and nutritive quality of pasture species

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Key Findings

- Pasture species were out competed when sown with Fathom barley.
- Even when pasture species were sown as monocultures weed competition reduced biomass production in winter and summer.
- Fathom barley produced the most dry matter and the vetches and peas performed comparatively well.

Why do the trial?

Annual legume pastures have proven to be a highly effective weed management tool in low rainfall areas with the added benefits of nitrogen fixation and providing livestock with a valuable feed resource. However winter feed production is a major determinant of stocking rate and hence profitability of the livestock component of a mixed farming system and the winter productivity of many leguminous species limits stocking rate potential.

The pasture trial for 2013 was established to investigate the dry matter (DM) productivity and nutritive value (NV) of a range of pasture species sown independently or in conjunction with Fathom barley at Hart in winter and summer.

How was it done?

Plot size	3.7 m x 10 m	**Fertiliser**	DAP (18:20) + Zn 2% @ 75 kg/ha
Seeding date	27th May 2013		

The trial was a randomised complete block design with 3 replicates, with 13 varieties sown with or without Fathom barley. The pastures and forage mixtures and sowing rates are detailed in Table 1.

Simulated grazing over half the plots was carried out on 9th of August, 2013 (barley growth stage 32). Plots were mowed using a tractor and slasher cutting to a height of 5-7 cm (photo 1). All dry matter was raked and removed from mowed half plots.

All plots were assessed for dry matter production in both winter (28th August, 2013) and summer (11th December, 2013). Selected treatments were also analysed for feed quality at both these sampling dates.

Table 1. Plot number, species, variety and sowing rates of pastures and cereal at the Hart in 2013.

Plot	Species	Variety	Sowing rate kg/ha	Variety	Sowing rate kg/ha
1	Lucerne	SARDI 5	7		
2	Lucerne	Q31	7		
3	Lucerne	Creeping Lucerne	3		
4	Lucerne	SARDI 7, Series 2	7		
5	Vetch	Capello	45		
6	Vetch	Morava	45		
7	Sulla	Wilpena	12		
8	Clover	Arrow leaf - Zulu 2	10		
9	Balansa	Frontier	5		
10	Clover	SARDI Persian	8		
11	Medic	Angel	10		
12	Forage Pea	Hayman	80		
13	Barley	Fathom	80		
14	Lucerne	SARDI 5	7	Barley - Fathom	80
15	Lucerne	Q31	7	Barley - Fathom	80
16	Lucerne	Creeping Lucerne	3	Barley - Fathom	80
17	Lucerne	SARDI 7, series 2	7	Barley - Fathom	80
18	Vetch	Capello	45	Barley - Fathom	80
19	Vetch	Morava	45	Barley - Fathom	80
20	Sulla	Wilpena	12	Barley - Fathom	80
21	Arrow leaf clover	Zulu 2	10	Barley - Fathom	80
22	Balansa	Frontier	5	Barley - Fathom	80
23	Clover	SARDI Persian	8	Barley - Fathom	80
24	Medic	Angel	10	Barley - Fathom	80
25	Forage Pea	Hayman	80	Barley - Fathom	80

Results and discussion

Monocultures of pastures were cut and analysed for dry matter (DM) production and nutritive value (NV) by the SGS Australia laboratory on the 28th August and 11th of December, 2013. Nutritive value tests included crude protein (CP), metabolisable energy (ME), neutral detergent fibre (NDF), acid detergent fibre (ADF), dry matter digestibility (DMD) and dry organic matter digestibility (DOMD).

Dry matter production

Where species were sown as monocultures and no grazing was simulated (uncut), by August barley had produced the highest amount of DM per ha with no evidence of weed competition. Although Fathom barley produced the most DM/ha (Table 2), the vetches and peas performed comparatively well. The clovers, medics and lucernes barely produced enough dry matter to meet minimum ground cover requirements for soil stability and as such were highly susceptible to invasion by weed species.

Species	Variety	Dry matter (kg/ha)
Barley	Fathom	3214
Vetch	Capello	2380
Vetch	Morava	1718
Forage Pea	Hayman	1345
Clover	SARDI Persian	1066
Balansa	Frontier	869
Medic	Angel	683
Clover	Arrow leaf - Zulu 2	610
Sulla	Wilpena	546
Lucerne	SARDI 7, Series 2	424
Lucerne	Creeping Lucerne	307
Lucerne	Q31	261
Lucerne	SARDI 5	178

Table 2. Species, variety and dry matter production (kg DM/ha) of uncut pastures in August 2013.

Unfortunately the Creeping lucerne was competing with barley and all species with the exception of Fathom barley, Capello vetch and Arrowleaf clover had significant weed competition.

Where the pasture species were sown with barley in a forage mix, winter DM production exceeded 3 t/ha; the vetches

and forage peas were able to compete well with barley at 89% and 43% of the mix respectively. However, the remainder of the pasture species were completely out competed by the barley. Angel medic, SARDI Persian clover and Wilpena Sulla were the best of the competitors at 15%, 17% and 17% of the mix, respectively.

Cutting the pasture plots containing monocultures to simulate the effect of winter grazing significantly reduced the DM available at the August cut in all species except Capello vetch which produced 1357 kg DM/ha. Morava vetch was the next most productive species which yielded 893 kg DM/ha; this suggests that Capello vetch is more likely to tolerate winter grazing although by the end of the year the total DM production difference between Capello and Morava was only 300 kg DM/ha.

Where the leguminous pasture species were sown with barley the cereal effectively out competed any weeds however, the pasture monocultures suffered heavy weed infestation (annual ryegrass, Indian hedge mustard, milk thistle and wire weed) in particular balansa clover where the plot was 48% weed species by August (Table 3). SARDI 7 lucerne and Wilpena sulla were less affected (30 & 20% of the plots respectively) however, the weed populations were a significant proportion of the total DM/ha. Weed infestation was much greater where no simulated grazing had taken place (uncut).

Table 3. Total dry matter production (kg/ha) of cut and uncut species and varieties of pastures sown as monocultures at Hart December, 2013.

Species	Variety	*Cut/Uncut	% Weeds	Dry matter (kg/ha)
Barley	Fathom	uncut	0%	6,230
Barley	Fathom	cut	0%	4,020
Vetch	Morava	cut	13%	3,530
Clover	Arrow leaf - Zulu 2	uncut	33%	3,334
Vetch	Morava	uncut	12%	3,191
Vetch	Capello	cut	2%	3,003
Forage Pea	Hayman	uncut	27%	2,995
Vetch	Capello	uncut	4%	2,882
Sulla	Wilpena	uncut	25%	2,773
Balansa	Frontier	uncut	60%	2,771
Clover	Arrow leaf - Zulu 2	cut	27%	2,647
Balansa	Frontier	cut	57%	2,354
Clover	SARDI Persian	cut	47%	2,288
Clover	SARDI Persian	uncut	50%	2,282
Forage Pea	Hayman	cut	47%	2,196
Sulla	Wilpena	cut	23%	2,172
Medic	Angel	uncut	38%	1,865
Lucerne	Q31	cut	48%	1,333
Medic	Angel	cut	32%	1,284
Lucerne	Creeping Lucerne	cut	87%	1,196
Lucerne	SARDI 7, Series 2	cut	32%	1,158
Lucerne	SARDI 5	cut	20%	1,125
Lucerne	Creeping Lucerne	uncut	92%	1,118
Lucerne	SARDI 5	uncut	32%	958
Lucerne	SARDI 7, Series 2	uncut	40%	958
Lucerne	Q31	uncut	52%	917

Cut treatments do not include the portion of dry matter that was cut and removed during the simulated grazing event.

By December all pasture plots sown with barley out-yielded those sown with traditional pasture species such that all the plots were significantly barley-dominant. The vetches and one plot of Arrowleaf clover were the most competitive legume species (Table 4) with medic and balansa clover having been totally overwhelmed by barley.

Table 4. Total annual dry matter production (kg/ha) of cut and uncut species and varieties of pastures sown with barley at Hart December, 2013.

Species	Variety	*Cut/Uncut	Sown species (%)	Barley %	Dry matter (kg/ha)
Medic	Angel	uncut		100%	6,640
Lucerne	Creeping Lucerne	uncut	0%	100%	6,457
Lucerne	SARDI 5	uncut	3%	97%	6,289
Sulla	Wilpena	uncut	7%	93%	6,281
Clover	Arrow leaf - Zulu 2	uncut	13%	87%	6,129
Vetch	Morava	uncut	23%	77%	5,883
Balansa	Frontier	uncut		100%	5,881
Lucerne	Q31	uncut	3%	97%	5,825
Clover	SARDI Persian	cut	2%	98%	5,699
Clover	SARDI Persian	uncut	2%	98%	5,698
Vetch	Capello	uncut	30%	70%	5,485
Lucerne	SARDI 7, series 2	uncut	5%	95%	5,441
Lucerne	SARDI 5	cut	7%	93%	5,268
Forage Pea	Hayman	uncut	2%	98%	5,141
Balansa	Frontier	cut		100%	4,294
Medic	Angel	cut		100%	3,996
Clover	Arrow leaf - Zulu 2	cut	28%	72%	3,927
Sulla	Wilpena	cut	17%	83%	3,915
Lucerne	SARDI 7, series 2	cut	8%	92%	3,899
Lucerne	Q31	cut	8%	92%	3,683
Vetch	Capello	cut	40%	60%	3,446
Forage Pea	Hayman	cut	1%	99%	3,437
Vetch	Morava	cut	28%	72%	3,411
Lucerne	Creeping Lucerne	cut	2%	98%	3,227

**Cut treatments do not include the portion of dry matter that was cut and removed during the simulated grazing event.*

Pasture quality

The benefits of legume break crops in cropping systems are well recognised however in many farming systems livestock complement the grain production as a risk management tool; livestock are valuable contributors to profitability if well managed. The challenge for mixed farmers is to incorporate leguminous monocultures into the system for nitrogen fixation and to more easily control grass weed populations, and to provide a balanced pasture to optimise livestock production.

Grazing pure stands of legume pastures in the winter poses significant nutritional challenges for livestock in terms of nitrate toxicity, ammonia toxicity, mineral deficiencies, twin-lamb disease, loss of body condition and subsequent mortalities.

Lambing ewes require 15% protein during lactation to optimise productivity however as is evident in Table 5, many pasture species exceed this level of protein during winter. Capello and Morava vetch appear the most likely to cause animal health problems if grazed as a monoculture at this time at 31.4% and 33.2% crude protein.

Q31 lucerne and Capello vetch retained sufficient concentrations of protein (16.2 & 14% respectively) after senescence to support weaned lambs in December. However, the digestibility of all the species had declined below that required to optimise growth and weight gain such that supplementation with a high energy cereal grain would be required. There was insufficient pasture available of the creeping lucerne and balansa clover to sample by December.

Table 5. Crude protein concentration (%) and dry matter digestibility (DMD %) of pasture species sown at the Hart in winter and summer.

Species	Variety	Crude protein %		Dry matter digestibility %	
		Winter	Summer	Winter	Summer
Vetch	Morava	33.2	10.7	66.1	52.9
Vetch	Capello	31.4	16.2	69.6	44.6
Lucerne	SARDI 5	28.6	12.6	70.1	64.9
Forage Pea	Hayman	28.1	12.2	70.9	53.4
Lucerne	Creeping Lucerne	26.9	n/a	73.8	n/a
Lucerne	Q31	26.0	14.0	73.6	65.1
Medic	Angel	25.9	8.2	69.1	42.1
Sulla	Wilpena	23.2	11.0	71.3	54.7
Balansa	Frontier	23.0	n/a	74.7	n/a
Lucerne	SARDI 7, Series 2	22.5	12.6	73.0	62.9
Clover	SARDI Persian	22.3	7.8	74.3	52.3
Clover	Arrow leaf - Zulu 2	19.4	12.8	74.5	58.1
Barley	Fathom	11.4	5.3	65.2	65.5

Barley is commonly high in crude protein (25-30%) when sampled in winter however Fathom, being an early maturing variety, had declined significantly in feed value by August such that in the Hart environment a later maturing variety might be a better choice as a grazing option. Although digestibility had declined by December, the grain in the head available to grazing livestock is an excellent complement to the straw and flag of the reminder of the plant material. Forage peas are an excellent grazing option for livestock however optimum grazing time is generally October in most years after which time the feeding value rapidly declines.

Autumn sown, leguminous pasture production in cold, low rainfall environments is significantly challenging when monocultures are required for grass weed control and the Hart trial results support this. Clovers, medics and lucerne do not proliferate in a competitive environment which, unless early selective weed control strategies are implemented, results in poor pasture establishment, productivity and persistence.

The lucerne varieties were well balanced in terms of nutritive value however their productivity would make it difficult to justify their inclusion in a mixed farming system as a short term pasture option; their persistence at Hart is yet to be determined.

As total dry matter production is a key profit driver for the livestock component of a mixed farming system and pasture establishment is an expensive undertaking, pasture species selection should be based on dry matter production potential, winter productivity and persistence (not yet assessed at Hart) rather than the newest variety on the market.

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Photo 1: Simulated grazing over half the plots was carried out on 9th of August, 2013.

Photo 2: (left) plot Morava vetch and (right) Wilpena Sulla sown with barley, taken October 24th, 2013.