PPS/DEDJTR Soil Constraints Trial – Autumn/Spring 2015

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Background

The PPS group is participating in the MLA Producer Research Sites program with *PROJECT NO. B.FDP.0051:* Perennial pasture persistence.
PPS is investigating the related factors in established phalaris pastures that impact on the persistence of phalaris. PPS is collecting data from forty pastures of PPS members which have been rated in line with their pasture composition. Analysis is currently being undertaken to determine if there are common factors in the long term success or failure of phalaris pastures in the region.
As an adjunct to the pasture investigation a soil constraint trial project has been undertaken as part of the project to investigate the effect of nutrient deficiencies on long term phalaris pastures. The trial is being conducted by PPS & DEDJTR

Trial Design

This trial will help tell us if soil constraints exist and if they are removed does phalaris and sub-clover increase in plant frequency to potentially increase the longevity of the pasture.

Experimental design and treatments:
Three replicates, plots 2 x 5 m. 8 treatments x 2 Nitrogen levels x 3 reps =48 plots.
(2-3 metre buffer around plot boundaries). = 56 x 24 m.
Treatments include:
1 Control (nothing)
2 Control (All)
3 Limed Control
4 Without trace elements
5 Without magnesium
6 Without potassium
7 Without sulphur
8 Without phosphorous

All treatments established with and without Nitrogen.

Site establishment & management
Establish site in winter 2015, fence off to control grazing and apply treatments. Lock up and come back in mid spring to take measurements. Open up to grazing and repeat again for the 2015 and 2016 with lock up occurring in winter and assessment in mid Spring to observe a clover or lime response which can take 2-3 years. Also observe response in winter as N response may occur 6-8 weeks after urea applied in autumn.
Re-apply fertiliser treatment (not lime) each autumn (2016, 2017).

Animal Management

Trials are located within an existing paddock and need to be fenced off to control stock grazing.

After each inspection, sheep could graze the area for no longer than 24 hours and be stocked to allow quick, even grazing of plots.

Fertilisers to be used: table 1

Fertiliser to be used and the typical amount to buy for an experiment with 3 replicates	Nutrient supplied	Approx rate applied (kg key nutrient /ha)	Rate applied (kg fertiliser /ha)	Rate applied (g fertiliser/10m^2)
Triple superphosphate (4 kg)	Calcium phosphate (also contains 1% sulphur)	30 (Ca) & 52 (P)	250	250
Epsom salts (1 kg)	Magnesium sulphate ($MgSO_4.7H_2O$) MW=246.47	6 (Mg) & 8 (S)	60	60
Sulphate of potash (1.5 kg)	Potassium sulphate (K_2SO_4) MW=174.26	44 (K) & 18 (S)	100	100
Gypsum (0.5 kg) Some gypsum sources are contaminated with phosphorus; ensure you have a P-free source.	Calcium sulphate ($CaSO_4.2H_2O$) MW=172.17 Used to balance S levels.	0, 12, or 23 (Ca) & 0, 9, or 19 (S)	0, 50 or 100	0, 50 or 100
Micronutrient mix (12 pkts) (Molybdenum trioxide 0.07; Boric acid 1.75; Copper sulphate 1.75; Zinc sulphate 3.5 g per pkt)	Molybdenum (MoO_3), boron (H_3BO), copper ($CuSO_4.5H_2O$), zinc ($ZnSO_4.7H_2O$)		Molybdenum trioxide: 0.07; Boric acid: 1.75; Copper sulphate: 1.75; Zinc sulphate: 3.5	1 packet + 1 litre of rainwater
Ammonium nitrate (6 kg) (or urea (5 kg) if ammonium nitrate is not available)	Nitrogen $NH_4(NO_3)_2$ MW=80.04 or (urea $O(NH_2)_2$) MW=60.06		300 (or 225 if urea)	300 (or 225 if urea)

The combinations of nutrients that are applied to make up each treatment: table 2

Subtracted treatment	Rate applied (g fertiliser/10m^2)					
	CONTROL A (All)	**-P**	**-K**	**-Mg**	**-micros**	**CONTROL B (Nil)**
Triple superphosphate	250		250	250	250	
Epsom salts	60	60	60		60	
Sulphate of potash	100	100		100	100	
Gypsum			100	50		
Micronutrient mix applied in1 litre of rainwater per 10m^2 plot	1 packet	1 packet	1 packet	1 packet		
Other nutrient treatments if required for the experiment						
Ammonium nitrate (or urea)	300 (or 225 if urea) N should be applied as a split application e.g. a third in the autumn and two-thirds just prior to spring.					
Lime	2000					

Repilcates: *table 3*

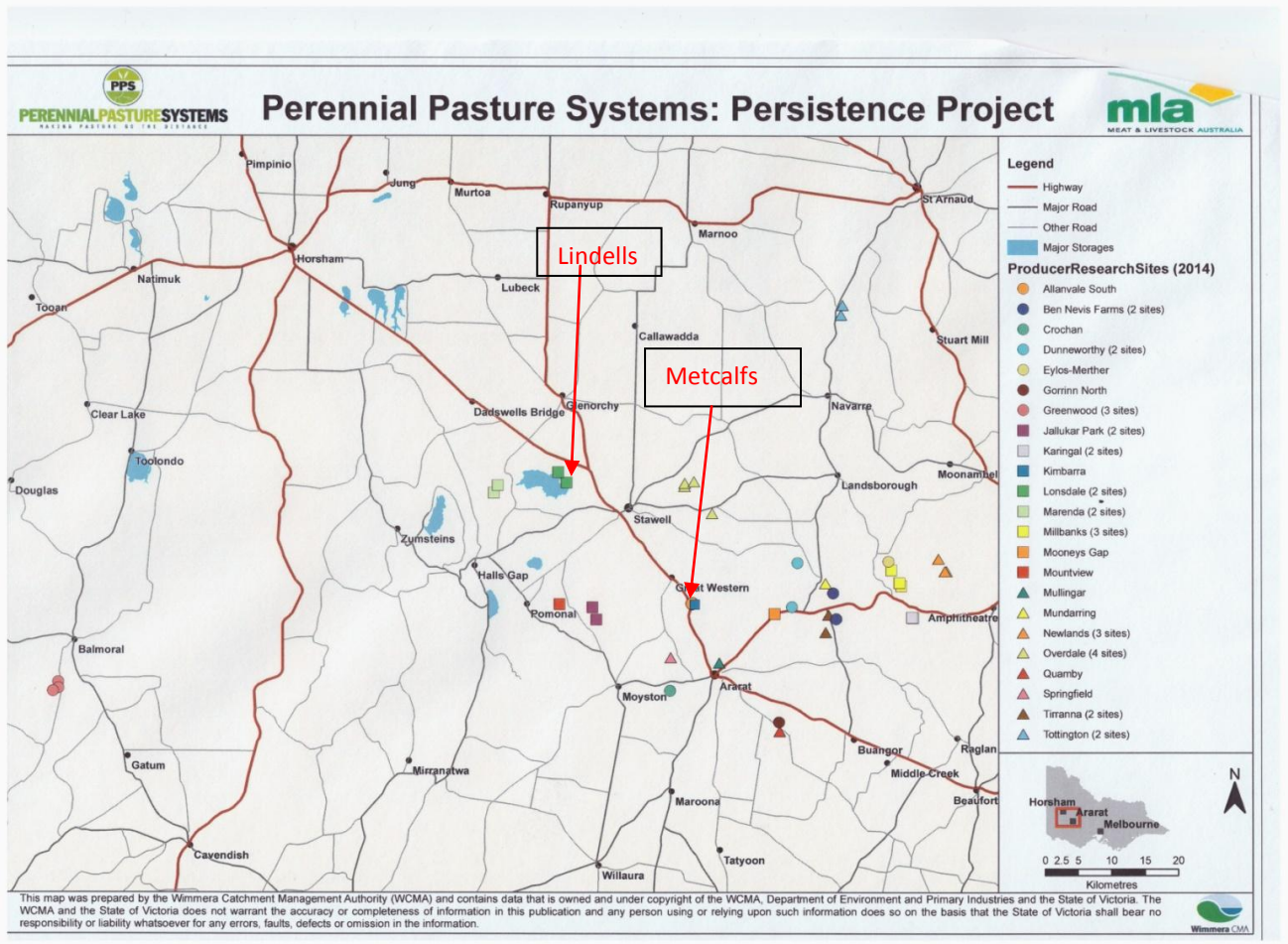
Replicate 1	CONTROL A	-P	-K (+N)	-Mg	-micros	CONTROL B (+N)
	CONTROL A (+N)	-P(+N)	-K	-Mg (+N)	-micros (+N)	CONTROL B
Replicate 2	-P(+N)	-K (+N)	CONTROL A (+N)	-micros (+N)	-Mg (+N)	CONTROL B (+N)
	-P	-K	CONTROL A	-micros	-Mg	CONTROL B
Replicate 3	-micros (+N)	-Mg (+N)	CONTROL B (+N)	-K	CONTROL A	-P(+N)
	-micros	-Mg	CONTROL B	-K (+N)	CONTROL A (+N)	-P

This experiment protocol was prepared by Richard Simpson and Adam Stefanski (CSIRO Plant Industry, Canberra) and Phil Graham (NSW DPI, Goulburn).
Contacts: richard.simpson@csiro,au , phillip.graham@dpi.nsw.gov.au

The trial was implemented in May 2015 at two sites.

Trial Paddocks

The two paddocks selected for the trial were at Lake Lonsdale and Great Western. They are marked with the arrows in the project map below.



Lindells

Lindells paddock is part of the Kindred Family property “Lonsdale” 10 km North East of Stawell in the Upper Wimmera region of Victoria. The paddock is located at GPS S37*01.524 E142*40.343 and has an elevation of 213 metres above sea level. The phalaris was established in the paddock in 2006.

Lindells Spring 2014

Metcalfs

Metcalfs paddock is part of the Kilpatrick family property “Allanvale South” 6 km South of Great Western in the Upper Wimmera region of Victoria. The paddock is located at GPS S37*11.212 E142*53.356 and has an elevation of 280 metres above sea level. The phalaris was established in the paddock in 1968 and oversown with phalaris in 1997.

Metcalfs Spring 2014

Pasture Composition

Pasture composition estimates were taken in the project paddocks during spring 2014. The results for the two paddocks in the soil constraints trial are shown in the table 4 below.

	% phalaris	% sub clover	% annuals rye,barley, brome	% grass weeds (silver grass, winter grass, fog grass, poa)	% Broadleaf weeds	% Onion Grass
Lindells	17	22	29	14	13	5
Metcalfs	20	29	22	18	6	5

Soil Tests

Soil tests were taken from the project paddocks in Autumn of 2015, samples were taken at 0-10cm and 10-30 cm. The results for the two paddocks in the soil constraints trial are shown in the table 5 below.

	Olsen p 0-10	Olsen p 10-30	pH (water) 0-10	pH (water) 10-30	pH (ca cl) 0-10	pH (ca cl) 10-30	Al saturation % 0-10	Al saturation % 10-30	S 0-10	S 10-30
Lindells	8.11	2.40	5.60	6.20	4.50	4.90	9.20	2.70	5.40	12.00
Metcalfs	10.40	2.73	5.50	5.80	4.80	4.70	2.20	5.10	9.80	4.60
	Cowell K 0-10	Cowell K 10-30	Organic C 10-30	Ex sodium % 0-10	Ex sodium % 0-10	Cu				
Lindells	117	94	2.0	9.2	19.8	0.10				
Metcalfs	145	113	2.5	5.8	10.4	0.45				

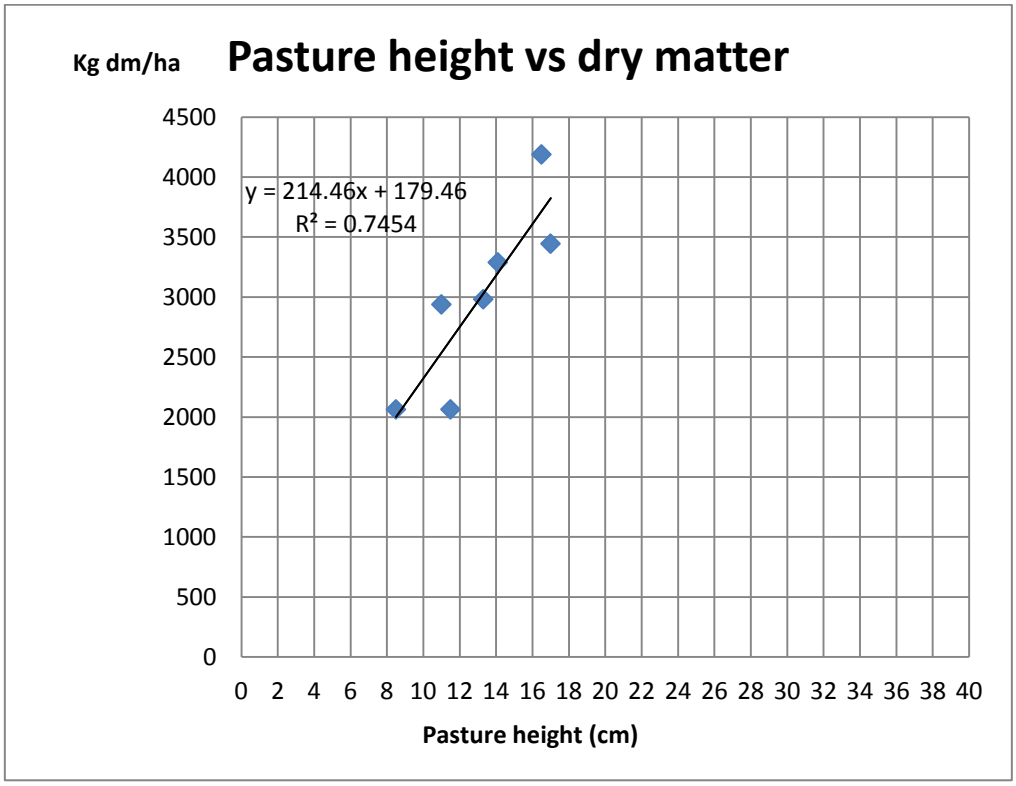
Measurements

Both trials were assessed visually in early September and replicates were rated for pasture growth with 10 = the best growth.

After this assessment it was decided to measure dry matter in Metcalfs paddock, it was decided that it was unnecessary in Lindells.

The dry matter assessment was done by using a pasture height meter (see below) and taking over twenty height measurements in each replicate. The height measurements were calibrated by cutting, weighing and drying samples from random replicates.

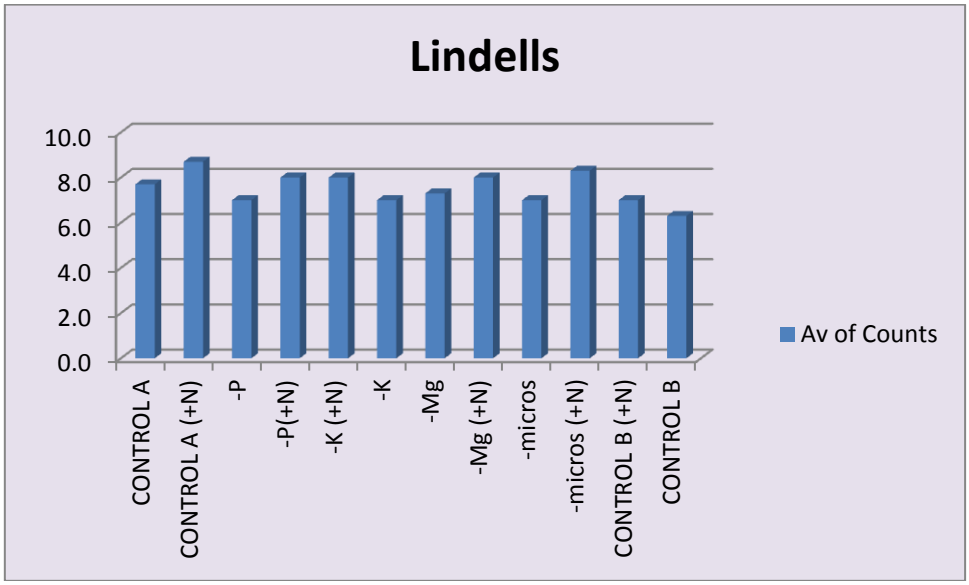
Dry Matter Calibration: table 6



Results
Visual Assessment 10 = Best growth

"Lindells" – Lake Lonsdale

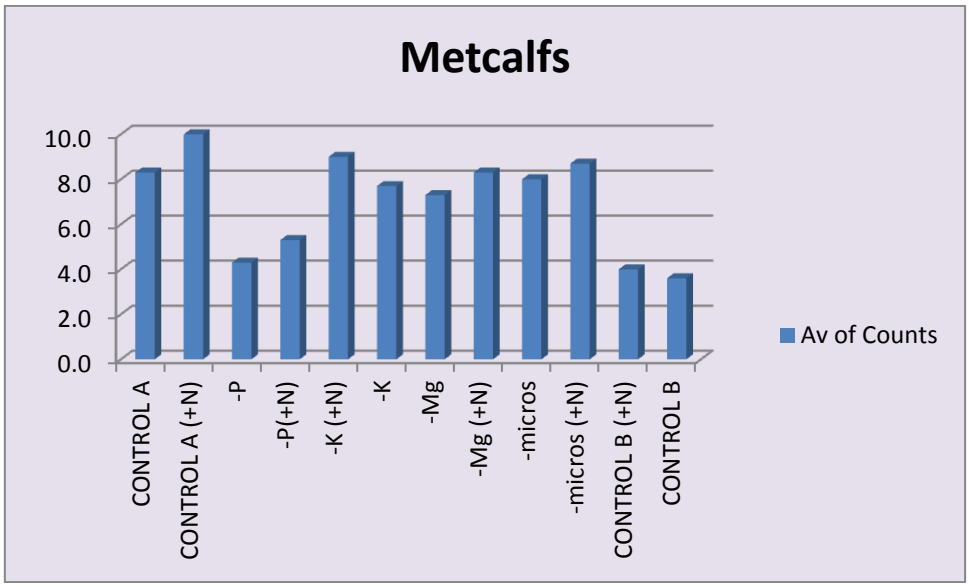
Lindells	Rep 1	Rep 2	Rep 3	Total	Avg
CONTROL A	7	7	9	23	**7.7**
CONTROL A (+N)	8	8	10	26	**8.7**
-P	7	7	7	21	**7.0**
-P(+N)	8	8	8	24	**8.0**
-K (+N)	8	8	8	24	**8.0**
-K	7	7	7	21	**7.0**
-Mg	7	8	7	22	**7.3**
-Mg (+N)	8	8	8	24	**8.0**
-micros	7	7	7	21	**7.0**
-micros (+N)	8	8	9	25	**8.3**
CONTROL B (+N)	7	7	7	21	**7.0**
CONTROL B	7	6	6	19	**6.3**



Results
Visual Assessment 10 = Best growth

“Metcalfs” Allanvale South Great Western

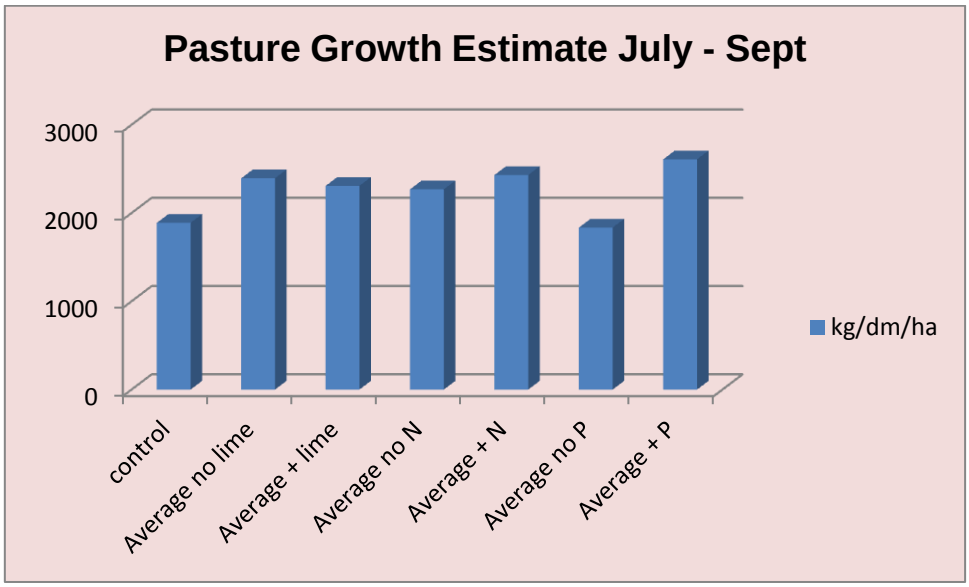
Allanvale South	Rep 1	Rep 2	Rep 3	Total	Avg
CONTROL A	8	9	8	25	**8.3**
CONTROL A (+N)	10	10	10	30	**10.0**
-P	5	5	3	13	**4.3**
-P(+N)	6	6	4	16	**5.3**
-K (+N)	10	8	9	27	**9.0**
-K	9	7	7	23	**7.7**
-Mg	8	9	5	22	**7.3**
-Mg (+N)	9	9	7	25	**8.3**
-micros	8	8	8	24	**8.0**
-micros (+N)	9	9	8	26	**8.7**
CONTROL B (+N)	4	4	4	12	**4.0**
CONTROL B	4	4	3	11	**3.6**



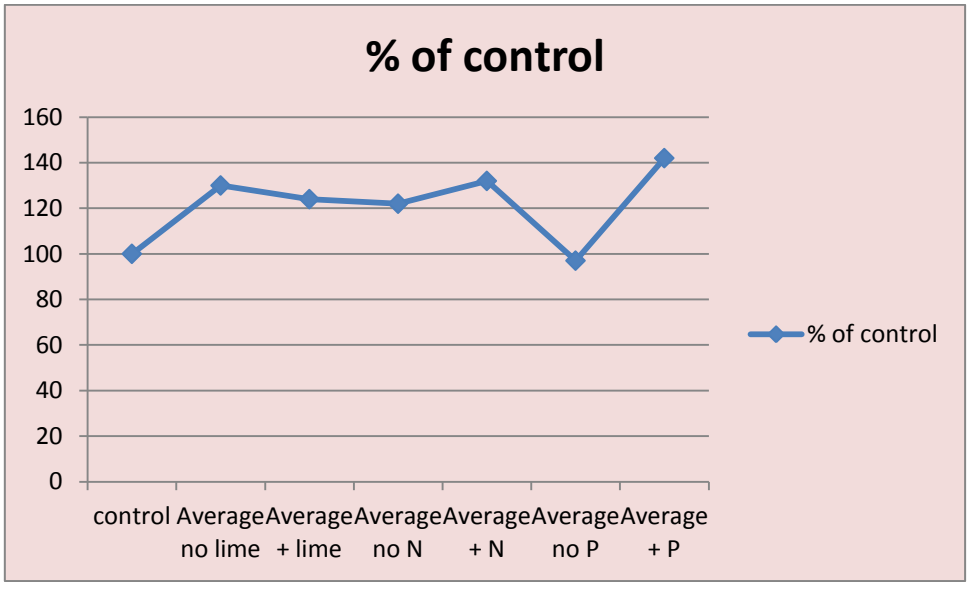
Results

Dry Matter Measurements

“Metcalfs” Allanvale South Great Western

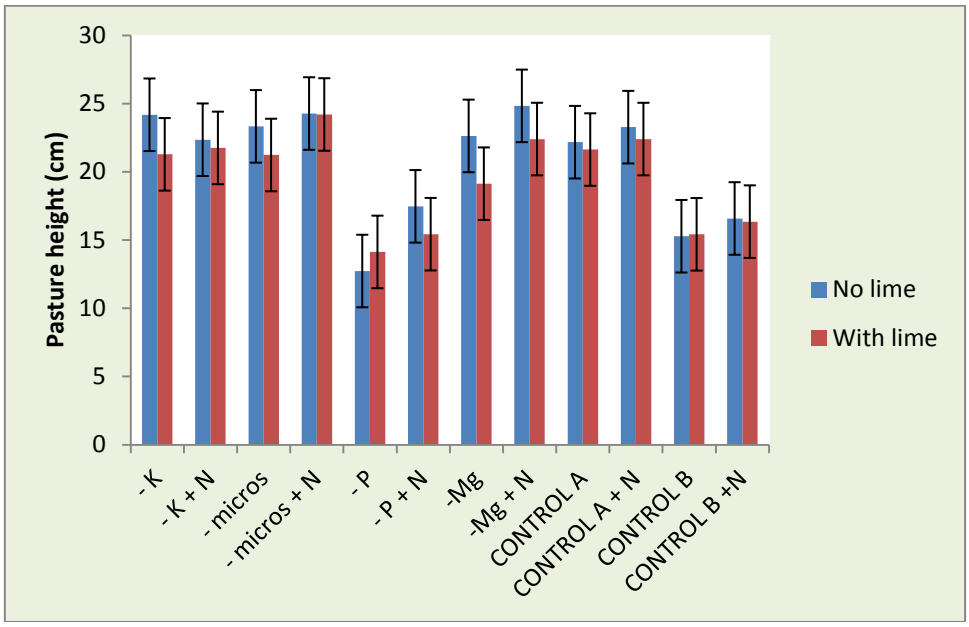


Graph 1 – Dry matter estimates Metcalfs (kg/dm/ha)



Graph 2 – Comparison of combined treatments Metcalfs

Statistical Analysis



Conclusions

Lindells

The visual assessment showed a small response to the nitrogen treatments but no other responses were detected

Metcalfs

Both the visual and dry matter assessments showed a response to the application of phosphorus fertiliser. As the paddock has an olsen p level of 10.40, this was an unexpected result.

General Discussion

The results show the value of trial strips before committing to expensive fertiliser programs.

Metcalfs with replicate that received a p application noted by the arrow