beef+lamb new zealand

INNOVATION FARM PROGRAMME

B+LNZ Innovation Farm field day

Increasing legume content on uncultivatable hill country

THURSDAY, 17 NOVEMBER 2016

Hamish and Annabel Craw

INNOVATION
FARM PROGRAMME

The Innovation Farm Programme is aimed at farmers who want to help identify tools and practices that will result in real financial improvements.

It focuses on developing new knowledge innovation and delivers results that can be picked up by early adopters and high-performing farmers.

Innovation farms projects are likely to be technical in nature and involve unproven or new-to-market technologies.

Innovation farm projects look at a narrow category of farming activity, rather than taking a whole-farm approach.

What did the project set out to achieve

Having already developed 80ha of cultivatable land using legume-based forage mixes and seeing the value these mixes were bringing in driving stock performance the Craws were motivated to find a pasture management strategy that would allow legumes to flourish on their uncultivated hill country.

Key drivers of the trial:

- Identify a technique that allowed existing clover to flourish, was reliable in summer dry conditions and enable introduce pasture species to establish and thrive
- Increase the MJME/kgDM/ha to assist in achieving wider business drivers of higher lamb weaning weights and creating opportunities to carry higher returning stock classes
- Grow an additional 3 tonne DM/ha from nitrogen fixation and improved grazing management

Our sponsors and support

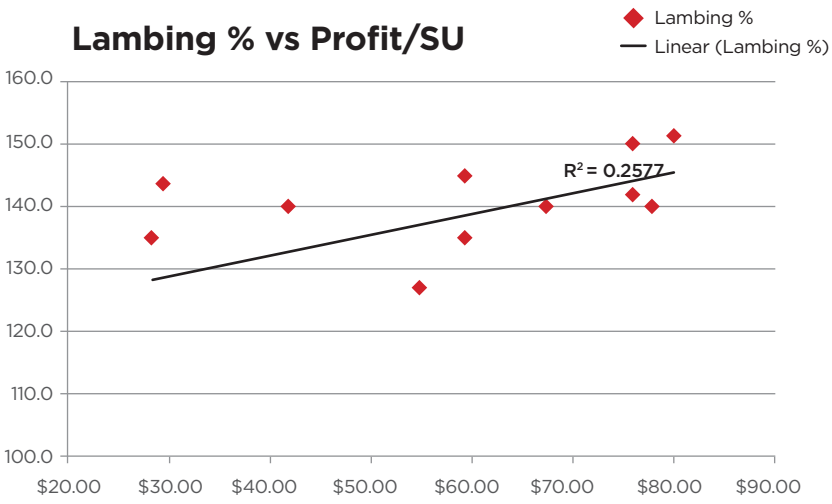
The Craws would like to thank all the sponsors for their support in particular Beef + Lamb New Zealand, Ravensdown, AgResearch, Abacus Bio and the following members of the project team whose knowledge and interest in this project has been invaluable.

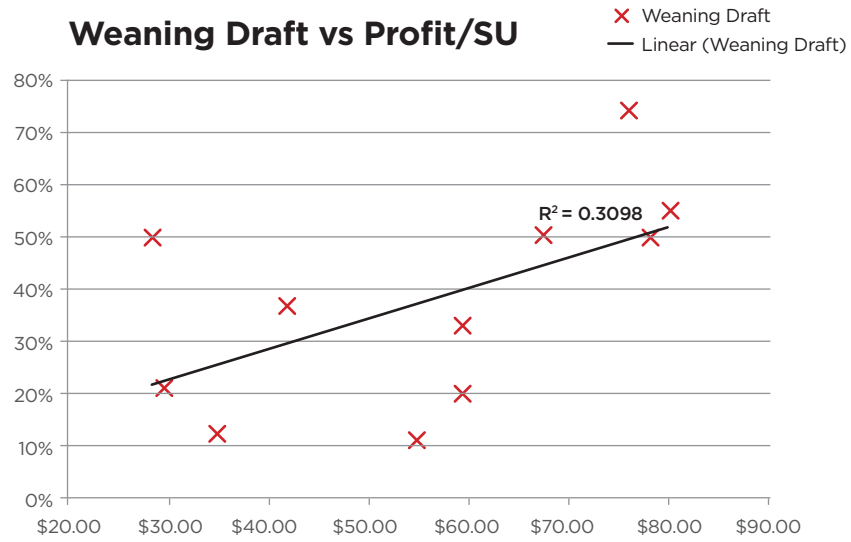
Hamish Craw - Trial manager
Annabel Craw - Project manager
Ray Moss - AgResearch, Trial technician
Dick Arnst - Consultant, Advisory member, agronomy
Rangi Holland - Ravensdown, Advisory member, fertiliser
Sarah O'Connell - B+LNZ Northern SI Extension Manager
Mike Williams - B+LNZ Northern SI Farmer Council Rep

What drives the business

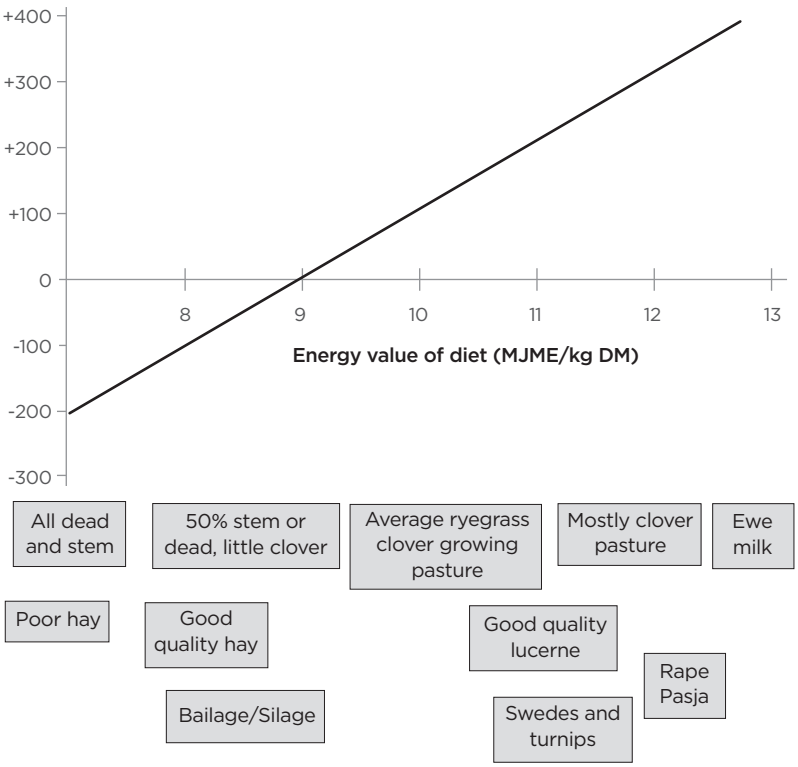
As members of the B+LNZ Sheep Profit Partnership Longridge Agriculture Ltd identified the key drivers to optimising their profitability was Lambing % and Weaning Draft and maximising both of these indicators had the greatest impact on increasing profit per stock unit. The charts illustrate this correlation.

Management decision around stocking policy, genetics and pastures are hugely influenced by the farms goal of improving on these indicators year on year.





Protein-rich legumes are recognised as being drivers of animal production, and in order to grow top quality replacement stock, reach body condition targets and accelerate liveweight gain in lambs to achieve the lambing % and weaning weight targets high energy feed must be supplied especially at critical times of the year. The chart to the right highlights the impact the energy value of the diet (MJME/kgDM) has on liveweight gain and it is these levels of 11 to 12 MJME/kgDM that Longridge Agriculture has set out to achieve on their uncultivatable hill country.



Trial site

The location of the trial site was chosen because:

- It represents the majority of uncultivable hill country on the property
- Easy to access for monitoring and able to be fenced off relatively simply
- Aspect is North East facing

Soil test results: Trial site, 30th September, 2014

pH	5.4
Olsen P	26
Calcium	4
Magnesium	27
Potassium	10
Sodium	9
Sulphate Sulphur	9
Ext. Org. Sulphur	10

Trial Site looking North, December 2014

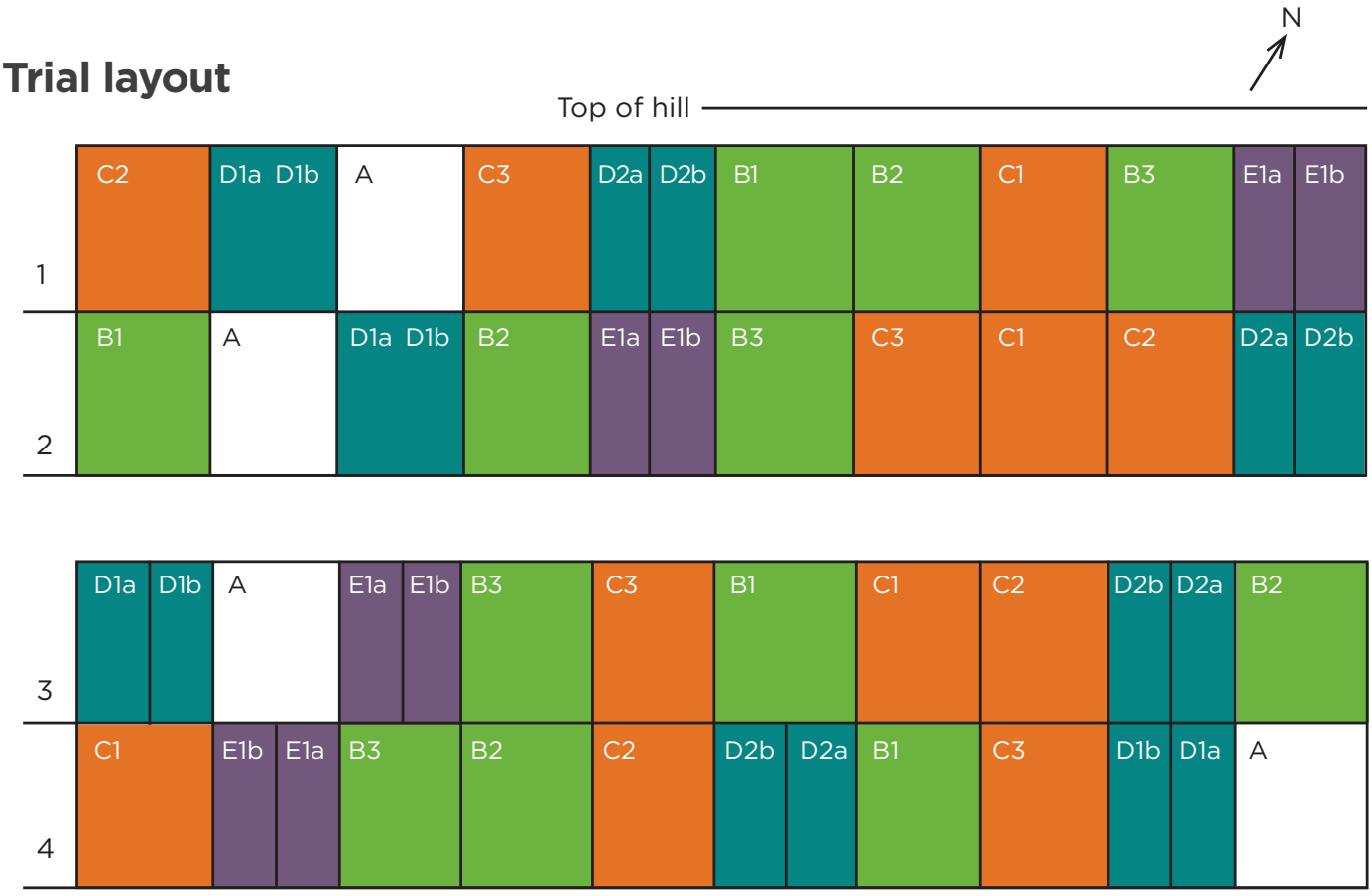
Trial site looking South, December 2014

Treatments

Three different chemical treatment approaches were trialled (light chemical top, heavy chemical top and grass eradication). Each treatment was repeated 4 times. The first application of spray was done on November 1, 2016. The treatments were evaluated the following Autumn (2015) to decide whether a follow up spray application was required and what seeding option would be used.

Pasture cuts were taken on an as needed basis depending on pasture cover and growth. Herbage mass and pasture composition was measured along with pasture quality. 3 tonne/ha of Lime was applied on 13 January, 2015

Trial layout



Farm Performance Data - Longridge Agriculture Ltd, B+LNZ Sheep Profit Partnership

	Benchmark	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	277	277	277	277	277	277	277
Sheep SU	2454	2427	2466	2744	2517	2517	2352
Tradition Sheep SU	1955	1986	1962	2198	2024	2024	1880
Ewes							
Mating Weight (Fleece Free)	70	67.2	66.4	66.2	69.1	71.8	71
Scanning %	170%	175%	178.5%	180.6%	187.3%	193%	191%
Tailing % - to Ram	145	143.7	148.1	145.7	147.2	150	155%
Weaning Weight	30	34	32.3	33.3	32.84	31.65	
Pre Wean Growth Rate	266	326	296	306	341	330	
Hoggets							
Mating Weight (Fleece Free)	48	47.5	49.7	48.5	48.5	50.5	56
Scanning %	116.0%	86.1%	125.9%	116.1%	132.0%	136.3%	141%
Tailing % - to Ram	90.0%	82.9%	101%	93%	105.0%	77%	104%
Weaning Weight	30	35.7	32.3	30.6	33.9	27.06	
Pre Wean Growth Rate	268	328	296	261	291	283	
% sold at weaning	34%	31%	29%	30%	35%	35%	

Treatments

Treatment	Trt code	Spring 2014	Autumn 2015
Control	A	Existing vegetation, grazed normally	
Light Chemical Top (no seed)	B1	Spray with 250ml/ha glyphosate	No re-spray No seed
Light Chemical Top (double spray, no seed)	B2	Spray with 250ml/ha glyphosate	Re-spray 2 l/ha glyphosate, No seed
Light Chemical Top (double spray, seed mix C)	B3	Spray with 250ml/ha glyphosate	Re-spray 2l/ha glyphosate Seed P21 legume (Mix C)
Grass Eradication (no seed)	C1	Spray with 0.5L/ha haloxyfop-p (Valiant)	No second spray No seed
Grass Eradication (seed mix C)	C2	Spray with 0.5L/ha haloxyfop-p (Valiant)	No second spray Seed P21 legume mix (Mix C)
Grass Eradication (seed mix B)	C3	Spray with0.5L/ha haloxyfop-p (Valiant)	No second spray Seed Longridge legume/grass mix, (Mix B)
Heavy Chemical Top (seed mix C)	D1(a)	Spray with 4L/ha glyphosate	No second spray Seed P21 legume mix (Mix C)
Heavy Chemical Top (double spray, seed mix C)	D1(b)	Spray with 4L/ha glyphosate	Re-spray 4L/ha glyphosate Seed P21 legume mix (Mix C)
Heavy Chemical Top (seed mix D)	D2(a)	Spray with 4L/ha glyphosate	No second spray Seed P21 legume/grass mix (Mix D)
Heavy Chemical Top (double spray, seed mix D)	D2(b)	Spray with 4L/ha glyphosate	Re-spray 4L/ha glyphosate Seed P21 legume mix/grass (Mix D)
Grass Eradication (follow up glyphosate, seed mix B)	E1(a)	0.5Lha haloxyfop-p (Valiant), & ProGibb	Spray 2l/ha glyphosate Seed Longridge legume/grass (Mix B)
Grass Eradication (follow up glyphosate, seed mix C)	E1(b)	0.5L/ha haloxyfop-p (Valiant), & ProGibb	Spray 2l/ha glyphosate Seed P21 legume (Mix C)

Seed mixes

(mix B) Longridge legume/grass mix	Variety	Rate (kg/ha)	Seed price per kg	Seed cost per ha
White clover	AberLasting	6	$15.54	$93.24
Red clover	Relish	2	$16.02	$32.04
Sub clover	3.5kg Leura 3.5kg Woogenellup	7	$11.25	$78.75
Plantain	Tonic	2	$16.02	$32.04
Ryegrass	Ultra	5	$9.86	$49.30
Cocksfoot	Greenly	4	$9.38	$37.52
Total		**26**		**$322.89**
(mix C) P21 legume mix				
White clover	Bounty	6	$15.54	$93.24
Red clover	Relish	4	$16.02	$64.08
Sub clover	3.5 Leura 3.5 Woogenellup	7	$11.25	$78.75
Lotus corniculatus	Birdsfoot	1.5	$25.00	$37.50
Lotus uliginosus	Trojan	0.8	$25.00	$20.00
Plantain	Tonic	1	$16.02	$16.02
Balansa clover	Bolta (or any other)	1.5	$9.39	$14.09
Total		**21.8**		**$323.68**
(mix D) P21 Legume/grass mix				
Perennial ryegrass	Ultra	10.5	$9.86	$103.53
Cocksfoot	Greenly	2.3	$9.38	$21.57
Phalaris		2.3	$16.68	$38.36
Prairie grass	Brono	12	$6.74	$80.88
White clover	AberLasting	3	$15.54	$46.62
Red clover	Relish	4.5	$16.02	$72.09
Sub clover	3.5 Leura 3.5 Woogenellup	7	$11.25	$78.75
Plantain	Tonic	1	$16.02	$16.02
Chicory	Choice	0.8	$21.81	$17.45
Total		**43.4**		**$475.28**

Treatment costs

Code	Treatment	Spring chemical	Autumn chemical	Chemical (Spring)	Chemical application (Spring)	Chemical (autumn)	Chemical application (autumn)	Seed (Autumn)	Seed application (Autumn)	Total cost/ha
A	Control	nil	nil	$0	$0	$0	$0	$0	$0	$0
B1	Light Chemical Top (no seed)	250ml/ha glyphosate	nil	$1	$100	$0	$0	$0	$0	$101
B2	Light Chemical Top (double spray, no seed)	250ml/ha glyphosate	2L/ha glyphosate	$1	$100	$9	$100	$0	$0	$210
B3	Light Chemical Top (double spray, seed mix C)	250ml/ha glyphosate	2L/ha glyphosate	$1	$100	$9	$100	$324	$0	$534
C1	Grass Eradication (no seed)	500ml/ha haloxyfop-p (Valiant)	nil	$90	$100	$0	$0	$0	$0	$190
C2	Grass Eradication (Seed mix C)	500ml/ha haloxyfop-p (Valiant)	nil	$90	$100	$0	$0	$324	$0	$514
C3	Grass Eradication (seed mix B)	500ml/ha haloxyfop-p (Valiant)	nil	$90	$100	$0	$0	$323	$0	$513
D1a	Heavy Chemical Top (seed mix C)	4L/ha glyphosate	nil	$18	$100	$0	$0	$324	$0	$442
D1b	Heavy Chemical Top (double spray, seed mix C)	4L/ha glyphosate	4L/ha glyphosate	$18	$100	$18	$100	$324	$0	$560
D2a	Heavy Chemical Top (seed mix D)	4L/ha glyphosate	nil	$18	$100	$0	$0	$475	$0	$593
D2b	Heavy Chemical Top (double spray, seed mix D)	4L/ha glyphosate	4L/ha glyphosate	$18	$100	$18	$100	$475	$0	$711
E1a	Grass Eradication (light chemical top, seed mix B)	500ml/ha haloxyfop-p (Valiant)	2L/ha glyphosate	$90	$100	$9	$100	$323	$0	$622
E1b	Grass Eradication (light chemical top, seed mix C)	500ml/ha haloxyfop-p (Valiant)	2L/ha glyphosate	$90	$100	$9	$100	$324	$0	$623

** Spring chemical application done via helicopter ** Autumn seed application done via annual fertiliser application*

CONTROL

Aside from lime no application of any chemical was applied to the control.
Pasture cuts of the control were done at the same time as all other treatment plots.

Control, December 2014

Control, March 2015

Control, June 2015, A

Control, June 2015, B

Control, October 2015

Control, November 2015

Control, November 2015

Control, February 2016

LIGHT CHEMICAL TOP (B1, B2, B3)

Aim: Eliminate the poorer grass species, suppress remaining grass growth and in turn promote clover growth.

Spring 2014: B1, B2, B3: 250ml/ha of Glyphosate was applied on 1st November 2014

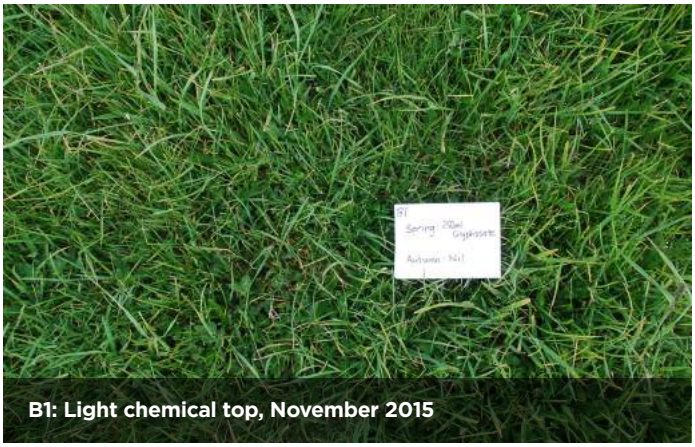
Light chemical top, December 2014

Light chemical top, January 2015 prior to second glyphosate application

Autumn 2015:
B1: No second spray, no seed

B1

B1: Light chemical top, no second spray, October 2015



B1: Light chemical top, November 2015

B2: 2L/ha glyphosate was applied on February 20th, 2015, no seed

B2

B2: Light chemical top, with follow up spray, October 2015

B2: Light chemical top with follow up spray, November 2015

B3: 2L/ha glyphsoate was applied on February 20th, 2015, seed mix C (P21 Legume Mix) on 27th February, 2015

B3

B3: Light chemical top, with follow up spray, October 2015

B3: Light chemical top with follow up spray, November 2015

Light chemical top, March 2015

Result: The low rate of glyphosate did not successfully eliminate the poorer grass species.
It was decided to go in with a follow up application of glyphosate in autumn on B2 & B3.

B1: Light chemical top, February 2016

Result: With the single application of a low rate of glyphosate in the spring there was little difference between this treatment and the control.

B2: Light chemical top with follow up spray, February 2016

Result: At what was considered a low rate of glyphosate (2L/ha) the treatment removed the majority of the plant population.

B3: Light chemical top with follow up spray, February 2016

Result: At what was considered a low rate of glyphosate (2L/ha) the treatment removed the majority of the plant population.

HEAVY CHEMICAL TOP (D1A, D1B, D2A, D2B)

Aim: Eliminate all grasses, suppress clover and create bare ground for new seed to be introduced. This treatment also aligned with the P21 project across New Zealand.

Spring 2014: D1a, D1b, D2a, D2b: 4l/ha glyphosate was applied on November 1st, 2014

Heavy Chemical Top, December 2014

Heavy Chemical Top January 2015

Autumn 2015:
D1a: No second spray, seed mix C (P21 Legume Mix) on 27th February, 2015

D1A

D1a: Heavy chemical top, seed mix C, June 2015

D1a: Heavy chemical top, seed mix C, October 2015

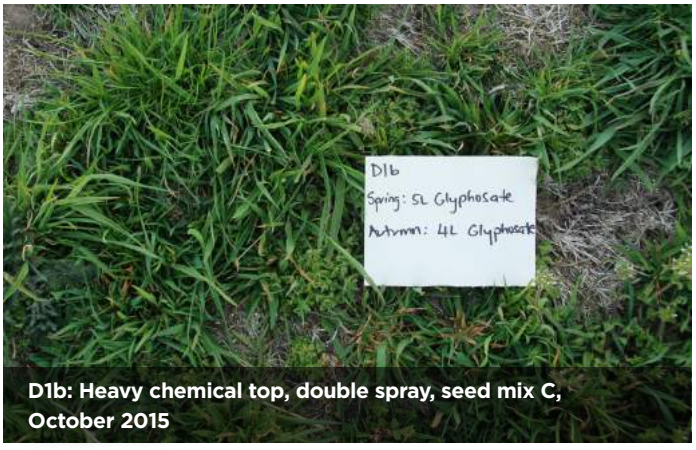
D1a: Heavy chemical top, seed mix C, November 2015

D1a: Heavy chemical top, seed mix C, February 2016

D1b: 4l/ha glyphosate was applied on February 20, 2015, seed mix C (P21 Legume Mix) on 27th February, 2015

D1B

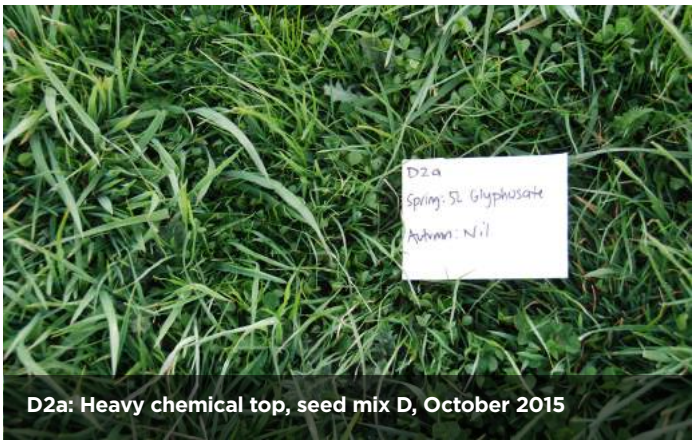
D1b: Heavy chemical top, double spray, seed mix C, June 2015



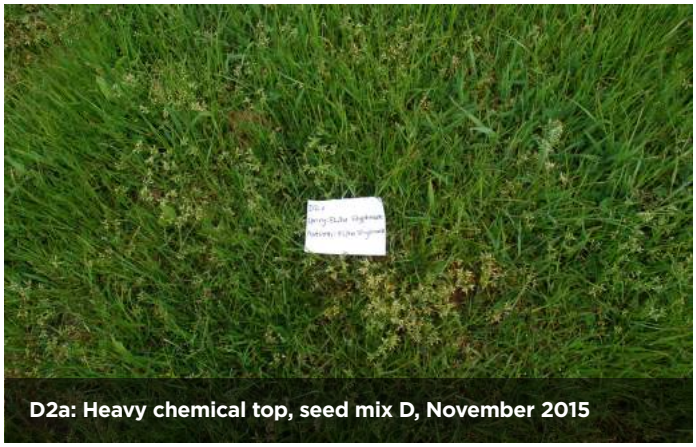
D1b: Heavy chemical top, double spray, seed mix C, October 2015

D2A

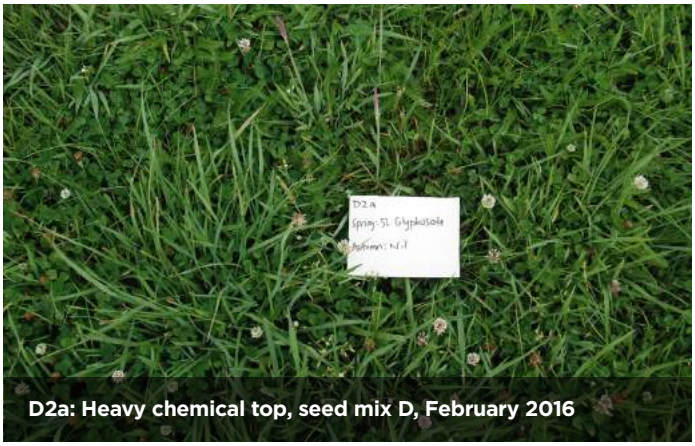
D2a: No second spray, seed mix D (P21 Legume/Grass Mix) on 27th February, 2015



D2a: Heavy chemical top, seed mix D, October 2015



D2a: Heavy chemical top, seed mix D, November 2015



D2a: Heavy chemical top, seed mix D, February 2016

D2B

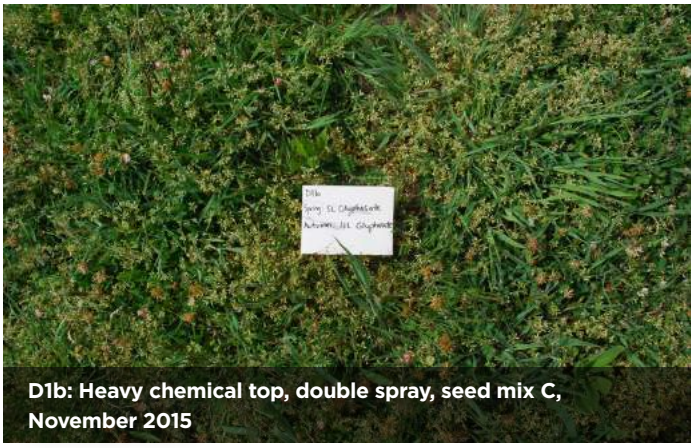
D2b: 4l/ha glyphosate applied February 20th 2015, seed mix D (P21 Legume/Grass Mix) on 27th February, 2015

D2b: Heavy chemical top, double spray, seed mix D, October 2015

D2b: Heavy chemical top, double spray, seed mix D, February 2016

D2b: Heavy chemical top, double spray, seed mix D, February 2016

The spring application of glyphosate showed quite good clover recovery. The treatments which received a second application in Autumn took out the majority of the plant population.



D1b: Heavy chemical top, double spray, seed mix C, November 2015

D1b: Heavy chemical top, double spray, seed mix C, February 2016

GRASS ERADICATION (C1, C2, C3)

Aim: Eliminate all grasses and retain and promote existing clover.

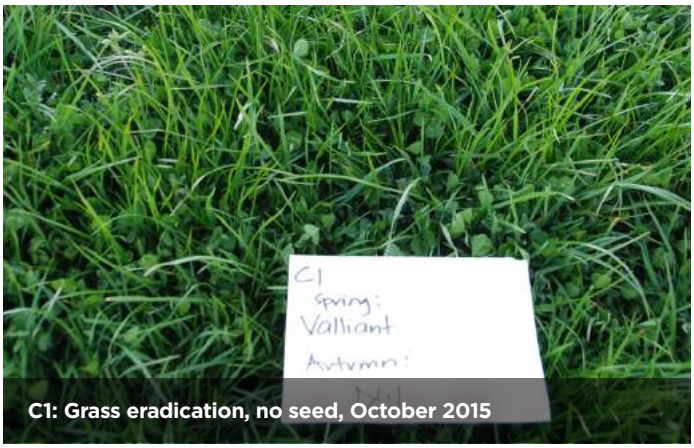
Spring 2014: C1, C2, C3: 500mL/ha haloxyfop-p (Valiant) on 1st November, 2014

Grass eradication, December 2014

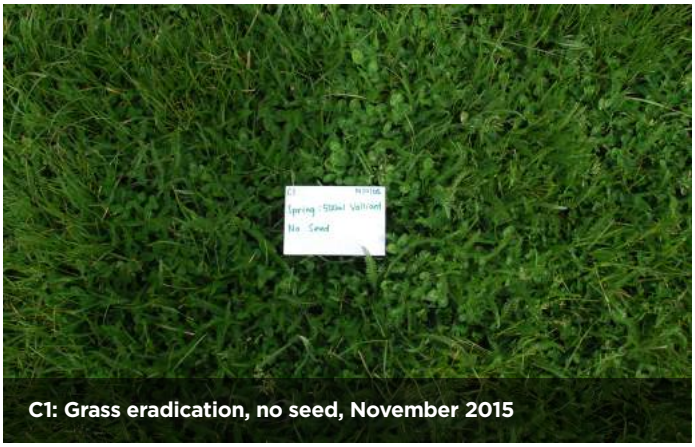
Grass eradication, January 2015

Autumn 2015:
C1: No second spray, no seedling

C1



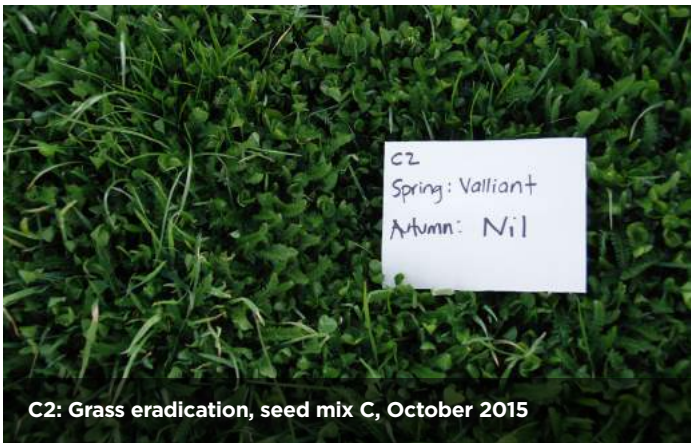
C1: Grass eradication, no seed, October 2015



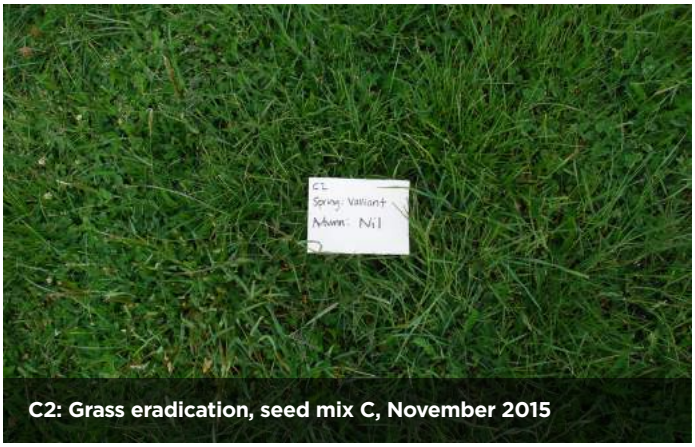
C1: Grass eradication, no seed, November 2015

C2: No second spray, seed mix C (P21 Legume Mix) on 27th February, 2015

C2



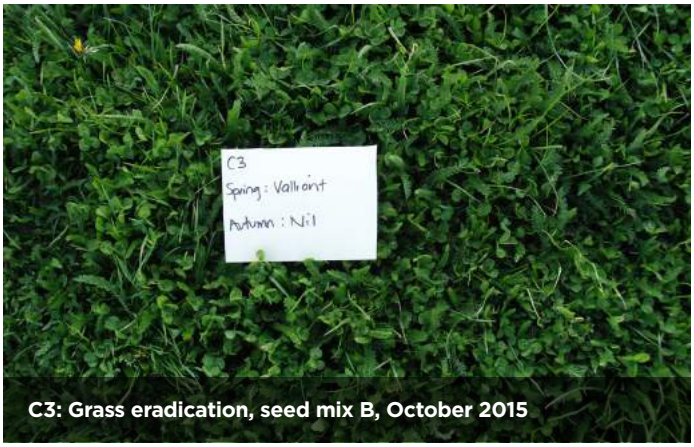
C2: Grass eradication, seed mix C, October 2015



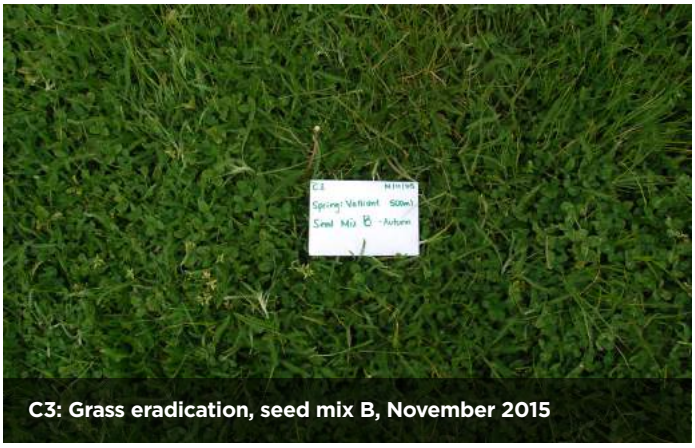
C2: Grass eradication, seed mix C, November 2015

C3: No second spray, seed mix B (Longridge Legume/Grass Mix) on 27th February, 2015

C3



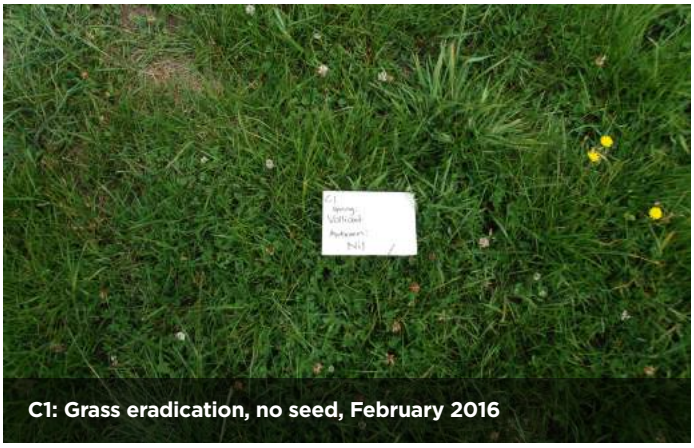
C3: Grass eradication, seed mix B, October 2015



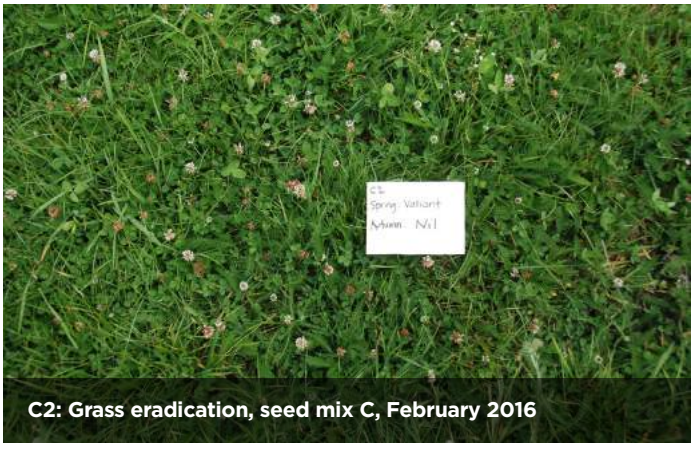
C3: Grass eradication, seed mix B, November 2015

Grass eradication, March 2015

Grass eradication, June 2015 A



C1: Grass eradication, no seed, February 2016



C2: Grass eradication, seed mix C, February 2016

Result: Initially the treatments looked very bare with small resident clover plants. As the clover began to kick back into gear so to did ryegrass and yarrow. What this treatment has done is kill off all the poorer performing grass species while maintain better quality ryegrass. Given the success of this treatment no follow up spray treatment was recommended prior to sowing seed.

C3: Grass eradication, seed mix B, February 2016 B

GRASS ERADICATION & LIGHT CHEMICAL TOP (E1 (A), E1(B))

Aim: Eliminate all grasses and retain and promote existing clover. ProGibb applied to increase clover production. Follow up spray to suppress remaining grasses.

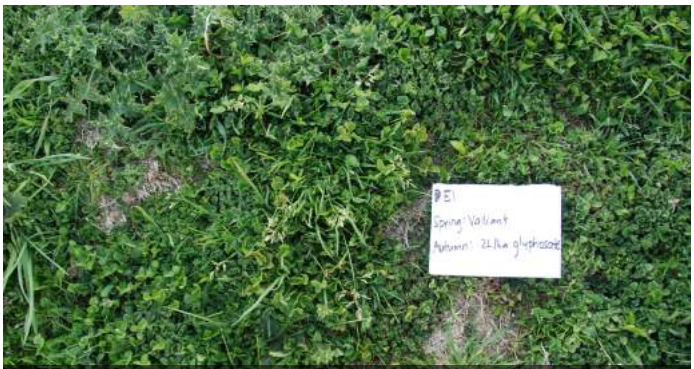
Spring 2014: E1 a & b: 500mL/ha haloxyfop-p (Valiant) on 1st November, 2014, recommended rate of ProGibb applied 23rd November, 2015

Grass eradication, January 2015 post ProGibb application

Autumn 2015:
E1a: 2l/ha glyphosate, seed mix B (Longridge Legume/Grass Mix) on 27th February, 2015
E1b: 2l/ha glyphosate, seed mix C (P21 Legume Mix) on 27th February, 2015

Grass eradication and follow up chemical top, June 2015 A

Grass eradication and follow up chemical top, June 2015 B

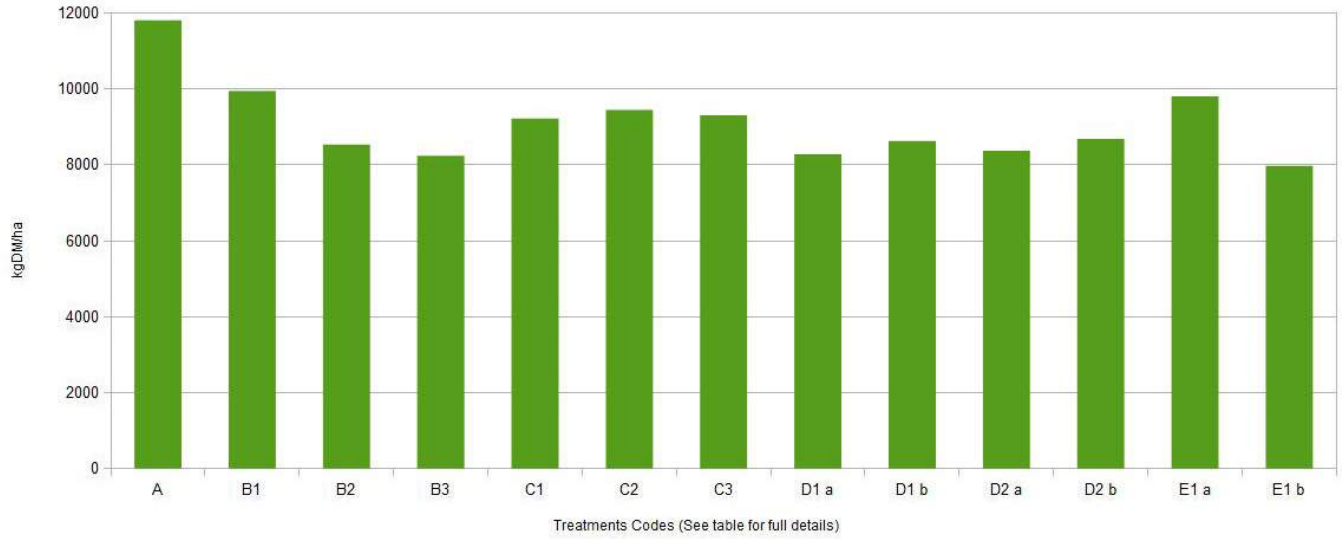


E1: Grass eradication followed by light chemical top, October 2015

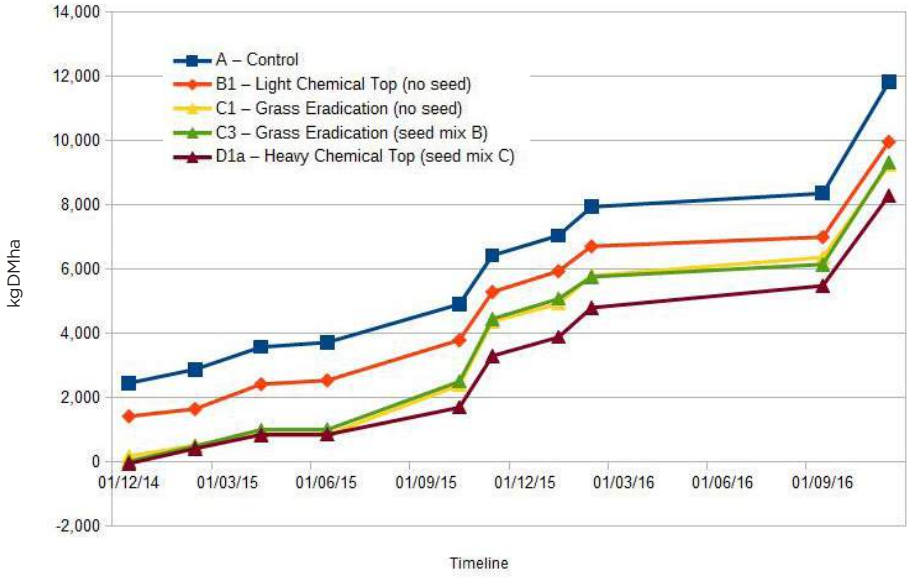
E1: Grass eradication followed by light chemical top, February 2016

E1: Grass eradication followed with light chemical top, November 2015

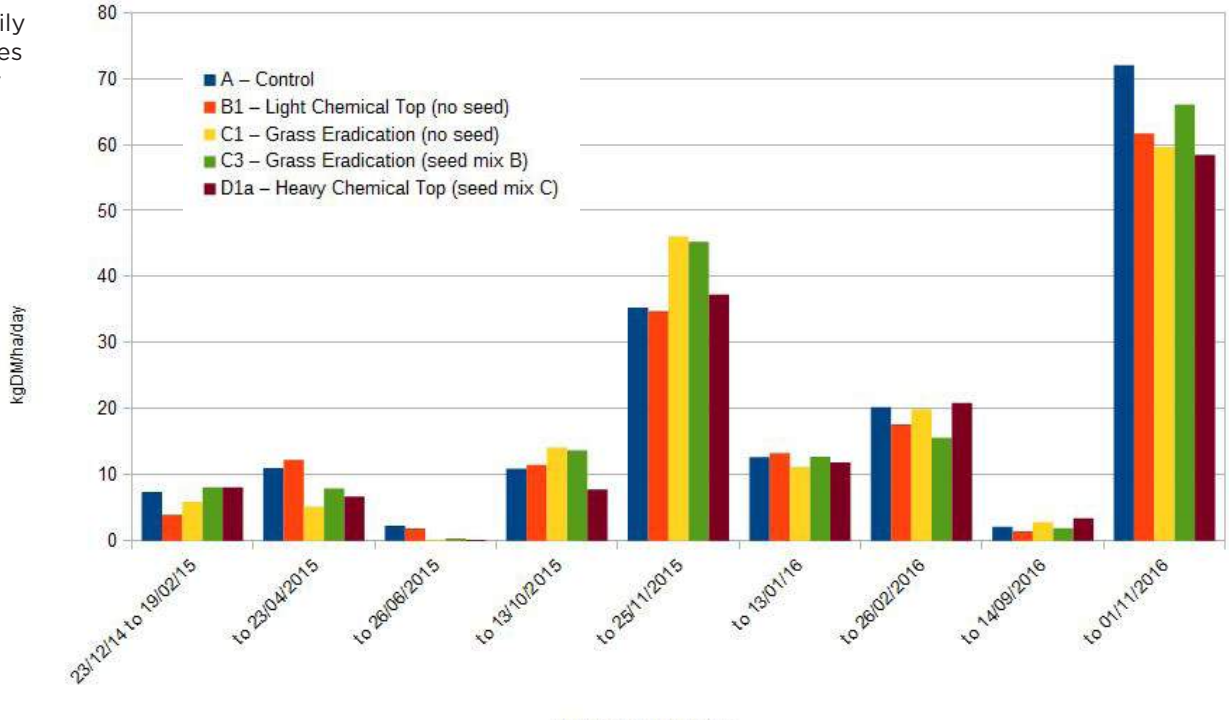
Total drymatter production kgDMha all treatments



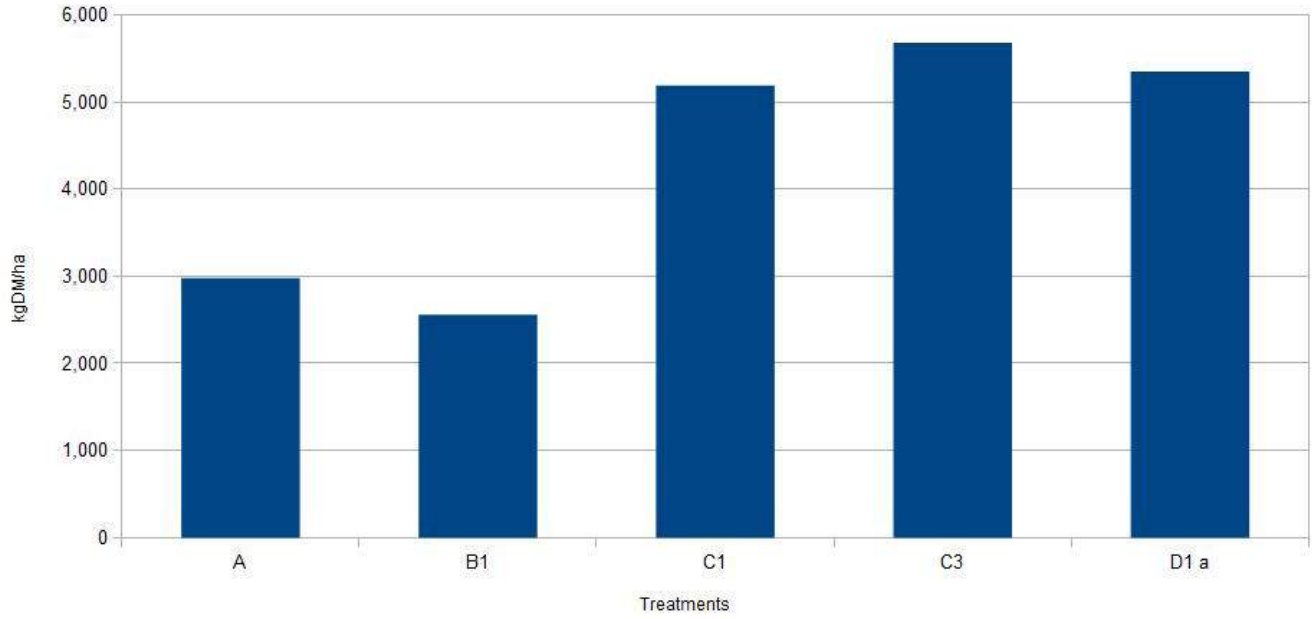
Accumulated total drymatter production kgDMha all treatments



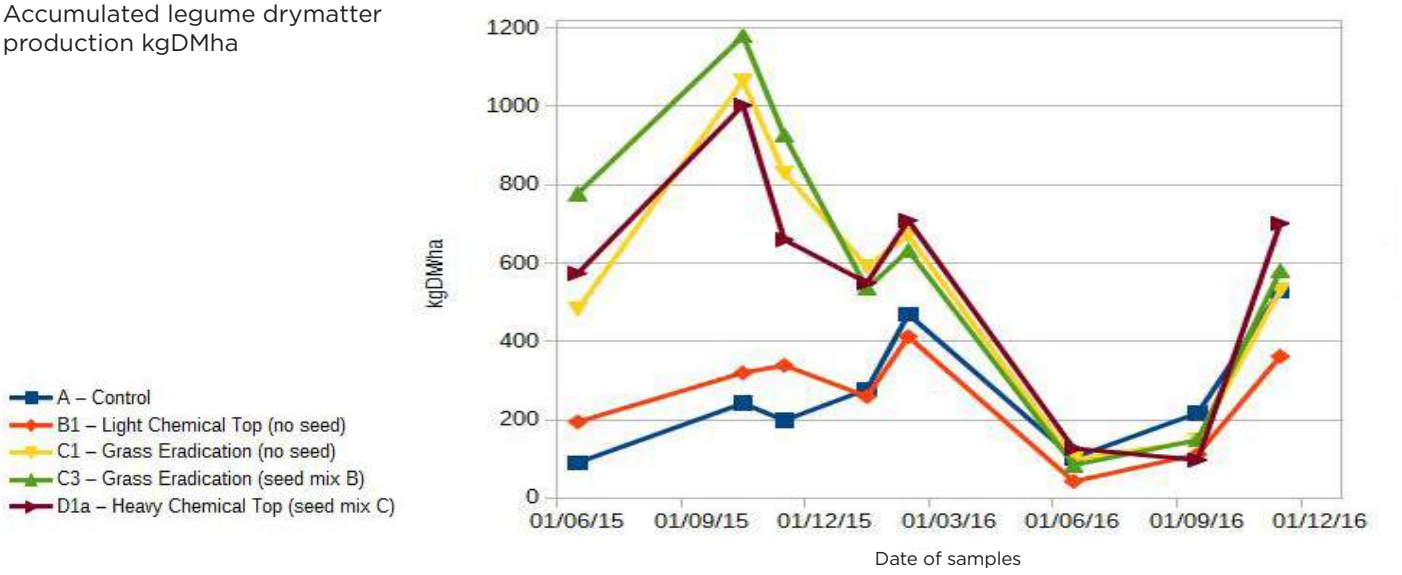
Average Daily Growth Rates kgDMhaday



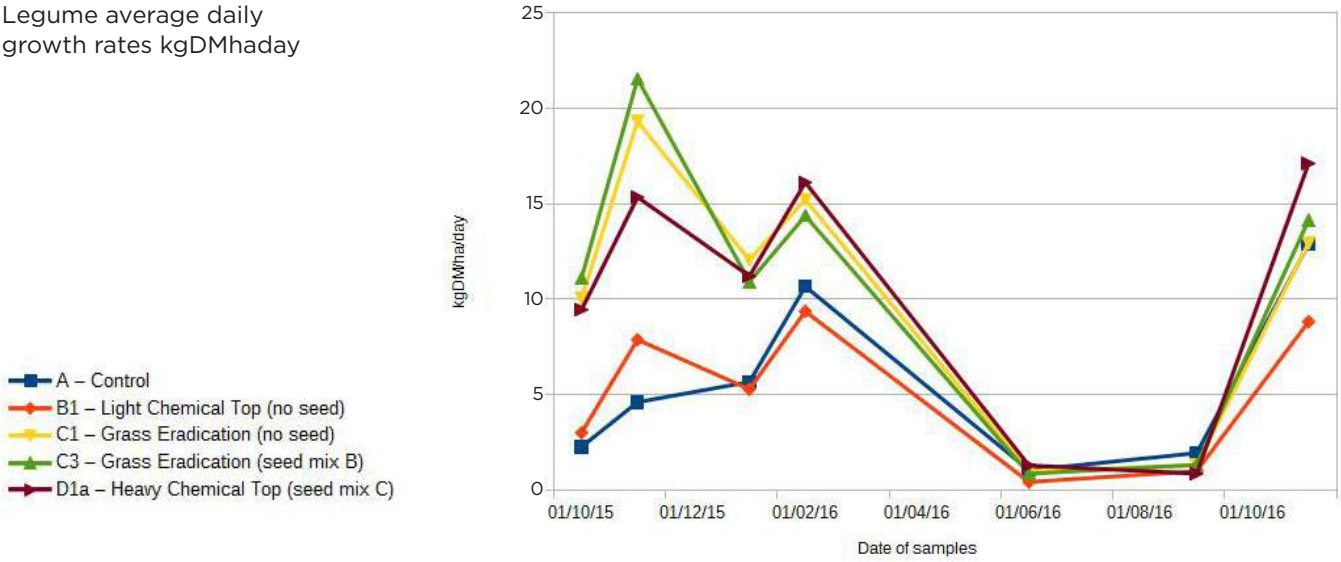
Legume total drymatter production kgDMha



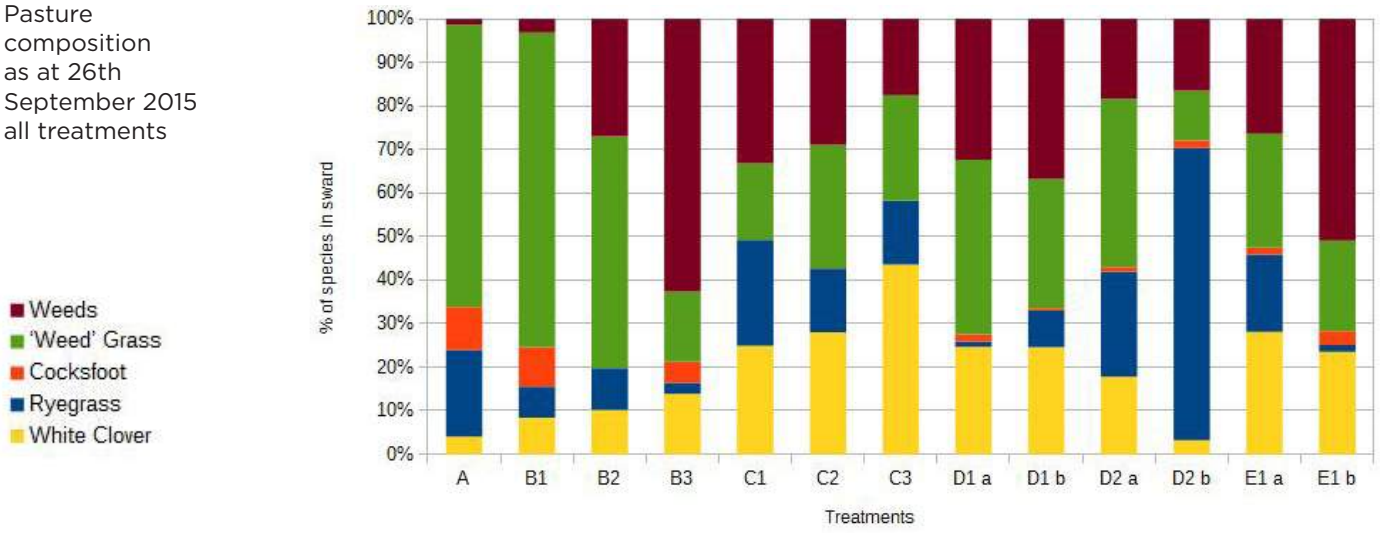
Accumulated legume drymatter production kgDMha



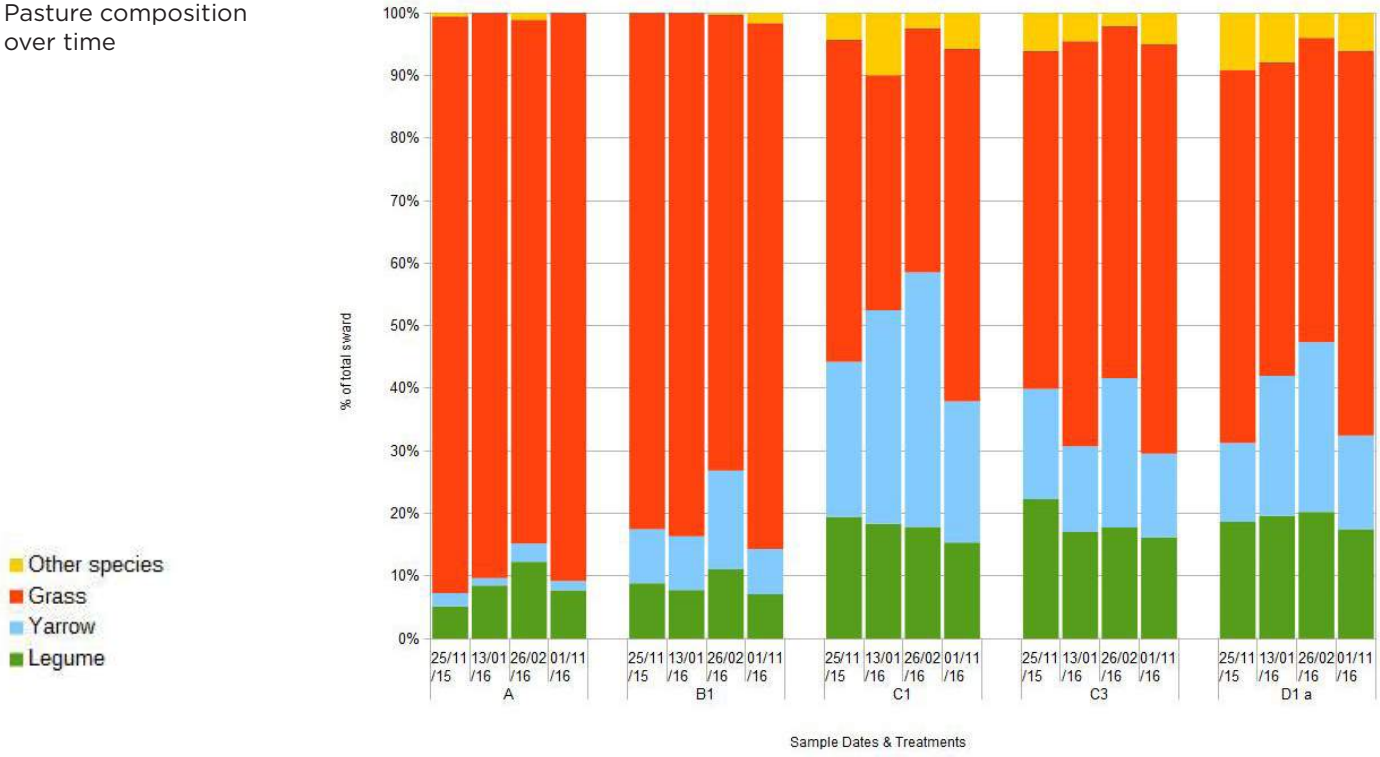
Legume average daily growth rates kgDMhaday



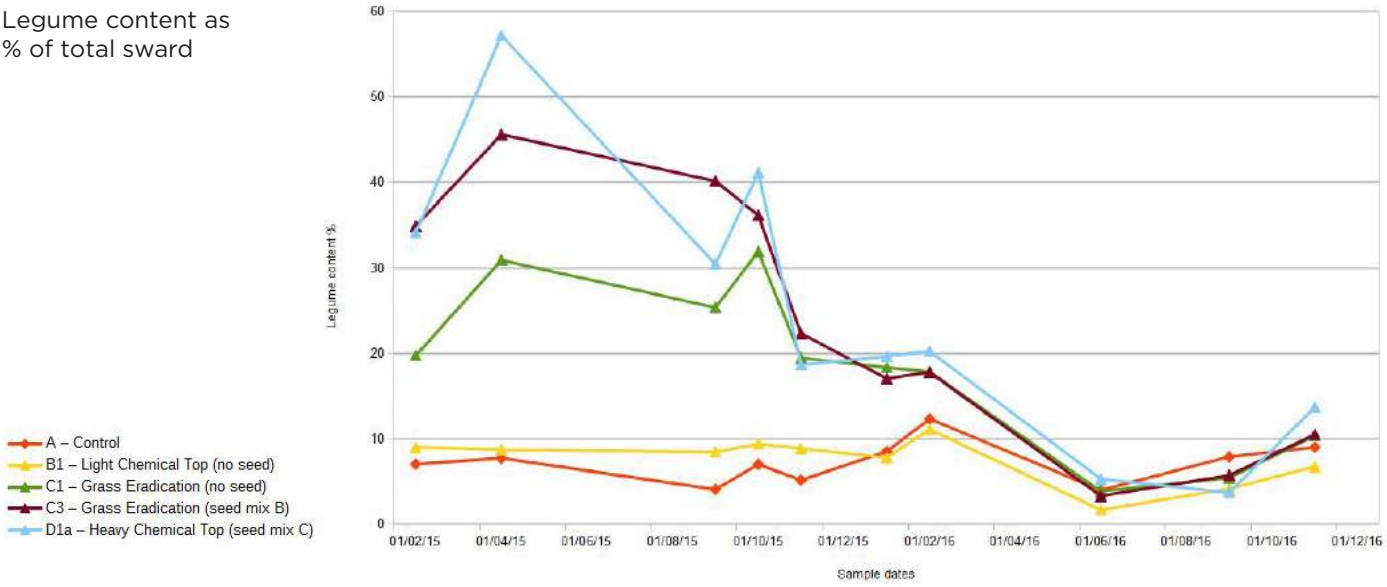
Pasture composition as at 26th September 2015 all treatments



Pasture composition over time



Legume content as % of total sward



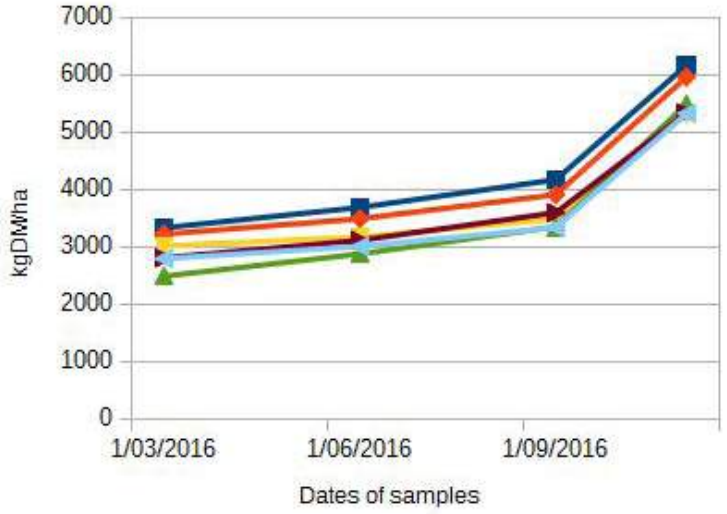
Valiant Rate Trial

To identify whether it was possible to reduce the application rate and in turn minimise the cost of the treatment while still achieving optimum result a second trial site was established. This trial focused on three different treatment rates along with the option of with or without collaborate oil.

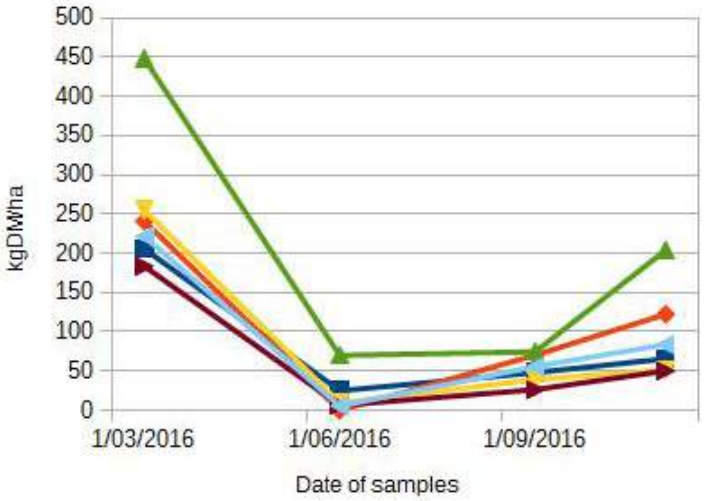
Weather conditions at the time of spray application were foggy and slightly damp. It appears from the data below and visual assessment that uptake by the plants was not as successful and did not follow the same pattern as the original trial, likely due to climatic conditions.

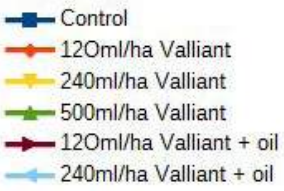
The project team decided that the trial was not worth pursuing due to the inconclusive data and focus should be directed to other areas going forward.

Valiant rate trial - accumulated drymatter production kgDMha

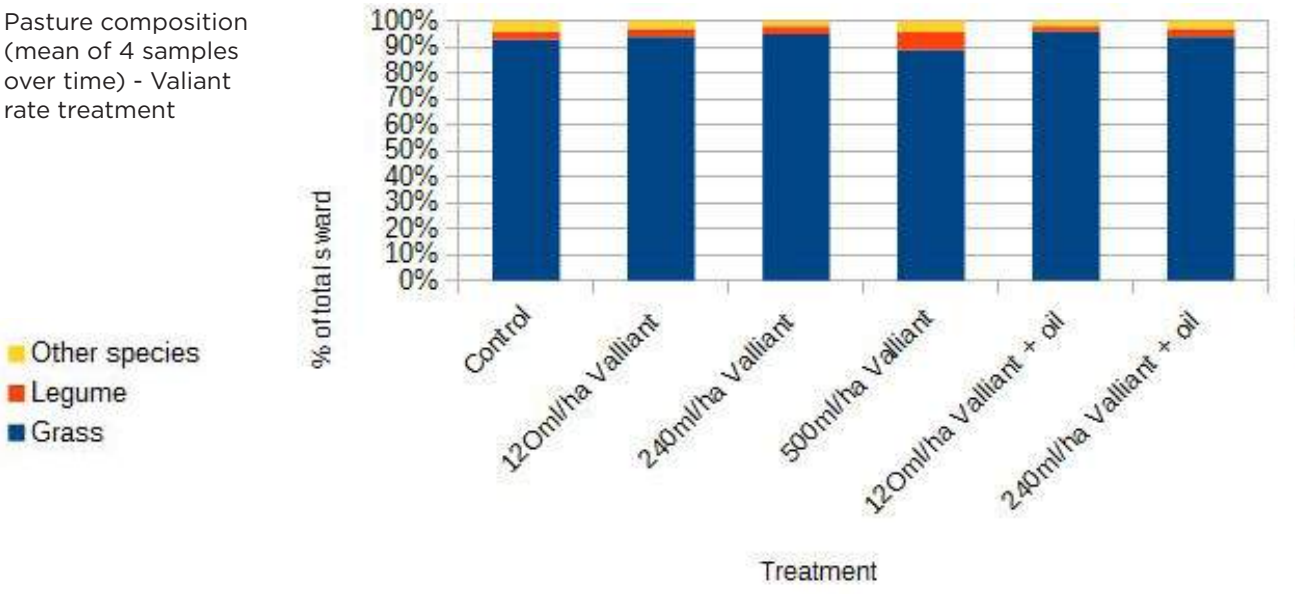


Valiant rate trial - accumulated legume drymatter production kgDMha





Pasture composition (mean of 4 samples over time) - Valiant rate treatment



1: Valiant rate trial, quarter rate, 120ml no oil, February 2016

2: Valiant rate trial half rate, 240ml no oil, February 2016

3: Valiant rate trial full rate, 500ml no oil, February 2016

4: Valiant rate trial quarter rate, 120ml with oil, February 2016

5: Valiant rate trial half rate, 240ml with oil, February 2016

6: Valiant rate trial, Control, February 2016

Yarrow management

Within the project team there was considerable discussion about the noticeable amount of Yarrow present in the Valiant treatments and whether this was a positive or negative. It was decided the nothing additional would be done to manage the Yarrow as spray options would have negative impacts on the overall sward and animals will happily graze the herb. The table below provides a breakdown of the yarrow plant compared to lucerne and ryegrass samples taken at a similar time on another property.

	Crude Protein	Digestibility of Organic Matter in Dry Matter (DOMD)	Metabolisable Energy	Soluble Sugars	Crude Fat	Organic Matter Digestibility in-vivo
	CP_%DM	DOMD_%	ME	SoluSug_%DM	CFat_%DM	OMDin-vivo_%DM
Yarrow	14.8	66.7	10.7	4.2	2.3	76.1
Lucerne	19.9	53.2	8.5	3.2	1.8	58.4
Grass Pasture	13.1	58.2	9.3	8.9	2	63

NEWTONS

The second year of the program was to decide on at least one treatment that could be scaled up and conducted over a larger area within a grazing system. The Valiant treatment ticked the most boxes due to the increased legume content achieved even under challenging climatic conditions, single application and cost of treatment. Approximately 5ha of paddock was spray out in the 'Newtons' block in the first week of December. Ideally the spray date would have been earlier but due to the dry conditions and below target pasture covers the decision was made to hold off to utlise the current feed. To provide an informal comparison of treatment verse control on the Newtons site only half the paddock was spray out.

Newtons pasture on large scale site prior to Valiant treatment, December 2015

Newtons large scale site prior to Valiant treatment, December 2015

**Newtons large scale Valiant site, February 2016
Control (right) Valiant (left)**

Newtons large scale Valiant site, February 2016

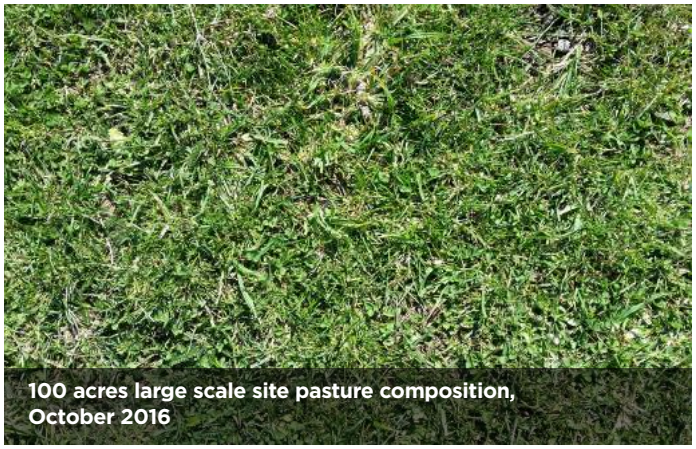
100 ACRES

With the result observed from the Newtons site and original trial the third year of the program is now focusing on replicating the Valiant treatment at another large paddock scale site but with more of a focus on ensuring a successful seeding of clovers either through reseeding of existing clovers (predominately subterranean clover) and introduced seed to increase the percentage of clover in the sward even further. Grazing management and 'resting paddocks' at critical times of the year will play a big part in achieving this goal.

Soil test results: 100 Acres, 18th October, 2016

pH	5.6
Olsen P	27
Calcium	9
Magnesium	61
Potassium	13
Sodium	14
Sulphate Sulphur	8
Ext. Org. Sulphur	15

100 acres large scale site paddock prior to spraying, October 2016



100 acres large scale site pasture composition, October 2016

100 acres large scale site chemical helicopter application, October 2016

100 acres large scale site chemical helicopter application, October 2016 B

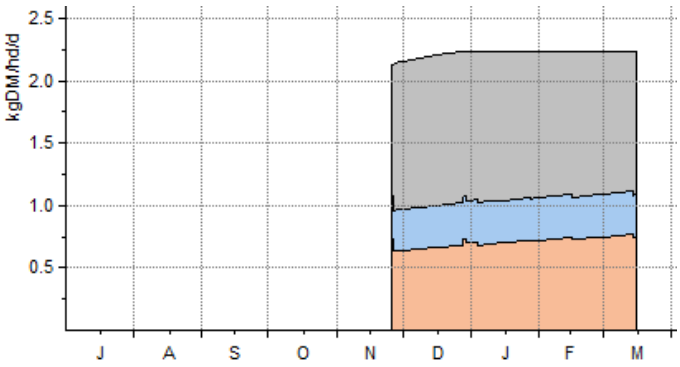
Feeding for Production:

Maintenance vs Production Feeding
Maintenance feed goes into sustaining daily body function, keeping an animal alive, while production feed goes into pregnancy, lactation, growth and wool production. In short feed that goes into maintenance keeps the animal alive while feed that goes into production generates income.

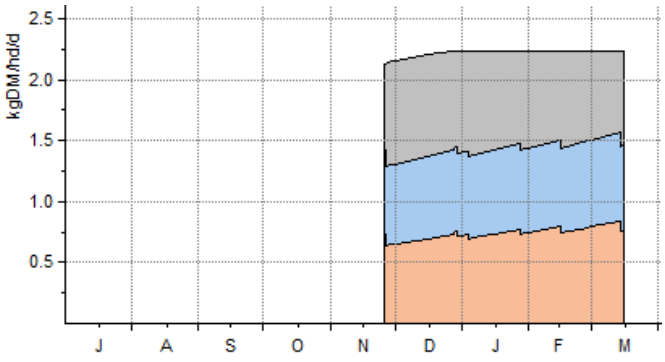
Maintenance feed requirements are closely related to bodyweight and increase as body weight increases. Maintenance feed requirements also increase slightly in cold winter conditions.

The graphs illustrate the portion of feed that goes to maintenance (bottom area of each graph), vs production (middle band) and the animals potential intake (top line).

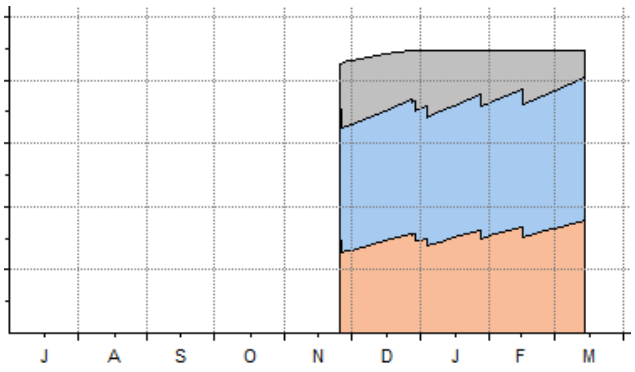
100 g/d Liveweight Gain



200 g/d Liveweight Gain



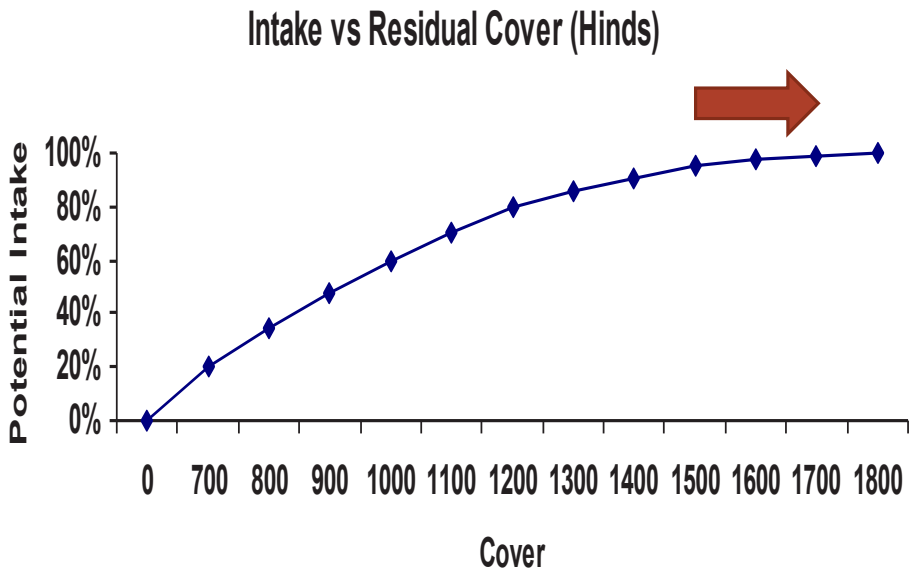
300 g/d Liveweight Gain



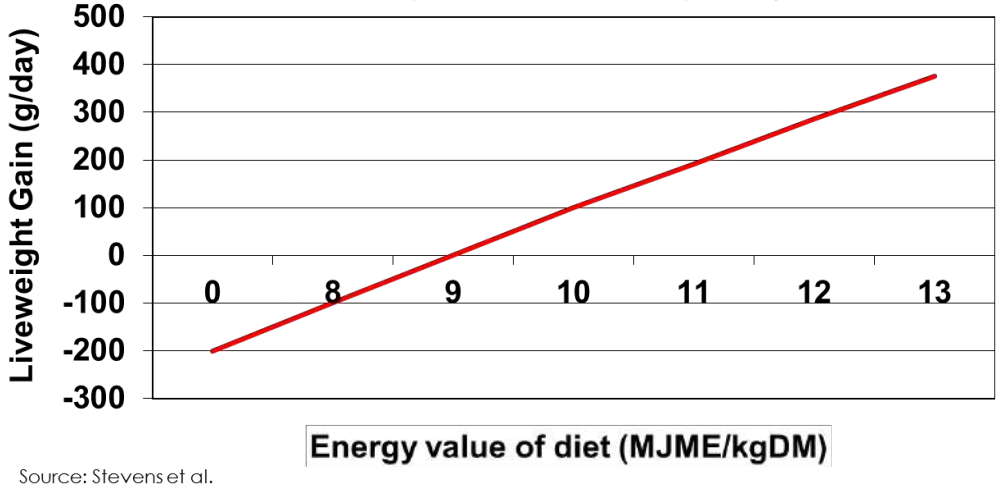
Similar efficiencies can be gained by feeding ewes better at critical times for production – pre tup, late winter and late lactation.

Enterprise	GM/Traditional SU	Intake (kgDM/SU)	GM/kgDM
135% lambing	$102	660	15.5
Marginal Difference	$8/SU	15 kgDM	53.6 c/kgDM
145% lambing	$110	675	16.2
Marginal Difference	$16/SU	37 kgDM	43.2 c/kgDM
145%, 70% Hoggets	$126	717	17.6
Marginal Difference	$25/SU	53 kgDM	47.2 c/kgDM
165%, 100% hoggets	$151	770	19.6

Increased production relies on having feed available at the critical times and promoting high intakes of high quality feed. Grazing to low residuals limits feed intake (below)



Impact of feed quality on Lamb growth Rates – 30 kg lamb)



Source: Stevens et al.

Maintenance	9 – 10 ME
Growth and Lactation	10.5 – 12+ ME +

Higher Quality = Better Production

Legumes, herbs and some forage crops provide top quality feed, particularly at times when grasses struggle for feed quality.

What ever we run, we are likely to have more productive and profitable farms if we grow more and higher quality feed. Pick the forage options that fit your environment and farm system.


beef+lamb
new zealand