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1 Introduction

Two trials were conducted to investigate the effect of LessN on pasture growth in spring. For comparison, a standard urea fertiliser was included in the treatment combinations. LessN is a bio-stimulant manufactured by Donaghys Industries Ltd. The trials were carried out on a Canterbury sheep and/or beef farm on free draining stony silt loam soils (Lismore soil) in Mid-Canterbury (Trial 1) and on a Waikato dairy farm on imperfectly drained soils (Te Kowhai) (Trial 2). Details of the sites are in the following section.

2 Site description

2.1 Trial 1 Canterbury - Sheep

Trial 1 was carried out at Winchmore Research Station, Mid-Canterbury on a Lismore silt loam soil. The treatments were applied to an established high producing pasture, which has historically been grazed by sheep. The main species within the pasture were permanent ryegrass and white clover (section 5.2 for more detailed pasture species composition). The paddock was irrigated via border dyke irrigation. The paddock chosen was of high fertility with an annual application of 150 kg/ha of DAP 13S fertiliser (diammonium phosphate with sulphur) and 0.5 kg/ha of Selenium prills. No nitrogenous fertilisers were applied to the site in the previous four months.

Figure 2.1: Trial site 1 at Winchmore Research Station, Canterbury showing trial plots (foreground of photo), 3rd October 2007.

2.2 Trial 2 Waikato - Dairy

Trial 2 was carried out at Ruakura's Number 1 dairy farm in central Waikato on Te Kowhai rhyolitic clay loam, a soil known for its poor drainage qualities in winter and gleyed subsoil. Treatments were applied to established high producing pasture which has been grazed by dairy cows for many years. The main species within the pasture at Number 1 dairy is permanent ryegrass (Bronsyn and/or Nui) and white clover (see section 5.2 for accurate pasture species composition). The paddock is not irrigated or fertilised but has effluent spread on it approximately 3 times over 2 years – last application in February 2007. The last application of urea was on 11 August 2006 (50kg/ha).

Figure 2.2: Trial site 2 at Ruakura Number 1 dairy unit, Waikato showing trial plots 11th September, 2007.

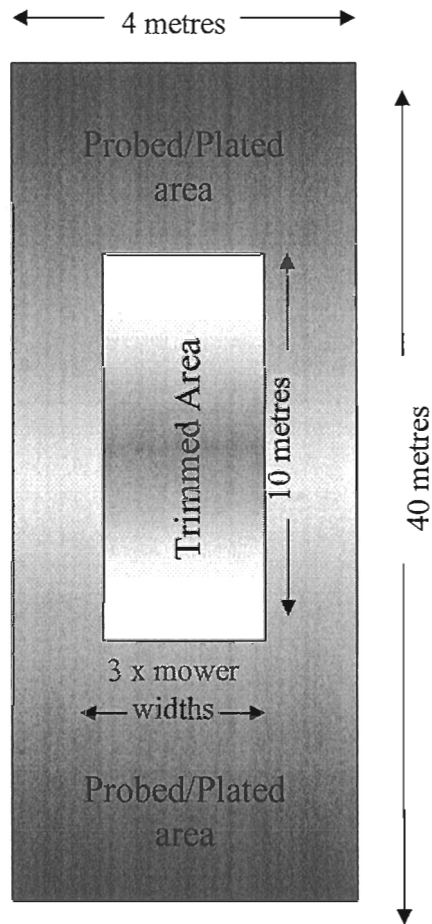
3 Trial design

Five treatments were randomly allocated in a randomised block design with five replicates (Table 3.1). The same design was used for both trials. Each plot was 40m x 4m (160m²) (Fig 3.1).

Table 3.1: Trial Design for Donaghys LessN Trials

	Plot No	Treatment No	Treatment
Rep ONE	1	3	80kg/ha Urea
	2	2	40 kg/ha Urea + 3 litres/ha LessN
	3	4	40 kg/ha Urea
	4	1	Control (No Urea or LessN)
	5	5	3 litres/ha LessN
Rep TWO	6	1	Control (No Urea or LessN)
	7	4	40 kg/ha Urea
	8	2	40 kg/ha Urea + 3 litres/ha LessN
	9	3	80kg/ha Urea
	10	5	3 litres/ha LessN
Rep THREE	11	2	40 kg/ha Urea + 3 litres/ha LessN
	12	3	80kg/ha Urea
	13	4	40 kg/ha Urea
	14	5	3 litres/ha LessN
	15	1	Control (No Urea or LessN)
Rep FOUR	16	3	80kg/ha Urea
	17	1	Control (No Urea or LessN)
	18	2	40 kg/ha Urea + 3 litres/ha LessN
	19	5	3 litre/ha LessN
	20	4	40 kg/ha Urea
Rep FIVE	21	2	40 kg/ha Urea + 3 litres/ha LessN
	22	5	3 litres/ha LessN
	23	3	80kg/ha Urea
	24	1	Control (No Urea or LessN)
	25	4	40 kg/ha Urea

Figure 3.1: Plot layout showing 1) centrally located trimmed area (used for actual Dry Matter yields and estimated pasture growth) and 2) probed/plated area (used for pasture cover, estimated Dry Matter measurements and pasture composition).



All fertiliser treatments were dissolved in tap water and applied at a rate of 200 litres/ha. The control had no urea or LessN applied but water was applied at 200 litres/ha,

The nitrogen fertiliser was Urea (46-0-0) supplied by Ravensdown Fertiliser Co-operative Ltd.

Paddocks were grazed evenly with sheep or dairy cattle prior to the commencement of the trial. No grazing of the plots occurred during the trial. The minimum pasture cover was at least 1200 kg/DM/ha at the beginning of the trial.

4 Measurements

The following measurements were taken prior to fertiliser application (day 1).

- *Soil fertility.* Soil samples taken across the trial area were analysed for the major soil nutrients (MAF Quick Test).
- *Pasture species composition.* Random clips were taken from each plot using hand shears. The clipped pasture was then sub-sampled, dissected, dried and weighed.
- *Pasture cover.* At site 1 (Canterbury) 60 random pasture probe (Tru-Test: GrassMaster II) readings were taken from around the outside of the trim area of each plot (Fig 4.1). Close proximity to power pylons at site 2 (Waikato) meant that a probe could not be used. Here pasture cover was measured using a pasture rising plate meter (Farmworks: electronic rising plate meter).

Figure 4.0: The author taking probe readings from around the outside of the trimmed area, Canterbury, 3rd October 2007.

- *Trim area preparation.* An area measuring 10 m by 3 mower widths was trimmed in the middle of each plot (Fig. 1.1). Thirty probe/plate readings were taken after mowing to determine the residual pasture mass.

The following measurements were taken at day 21 and 28 from each plot.

- *Pasture species composition.* Same procedure as day 1.
- *Actual dry matter yield.* One 10 m strip was cut using a rotary mower from the trimmed area in the middle of each plot (Fig. 4.1). The cut material was weighed green and a sub-sample was removed to calculate dry matter percent. This sub-sample was weighed green, dried and weighed again.

Figure 4.1: Mower strips taken for yield and actual pasture growth rate measurements on day 21 (left strip) and day 28 (right strip) at Trial site 1, Canterbury, 3rd October 2007.

- *Estimated dry matter yield.* Thirty pasture probe/plate readings were taken to measure pre and post-cutting pasture mass from within the trim area of each plot. This probe/plate data was used to derive the calibration equations to calculate pasture growth from the outer plot area. Sixty plate/probe readings were taken from the outer plot area.

5 Results

5.1 Soil Fertility

Soil fertility results for both sites are shown in Table 5.1 below.

Table 5.1: Soil fertility results taken at two sampling dates from Canterbury (Site 1) and Waikato (Site 2)

	Date	pH	Ca	Olsen P	K	SO ₄	Mg	Na
Site 1 (Canterbury)	05/09/07	5.6	7	49	9	11	4	15
Site 2 (Waikato)	06/09/07	6.2	9	43	28	10	8	48

5.2 Estimated pasture growth

Average pasture growth as estimated by mower yield and probe/plate data for both sites (Table 5.2).

Table 5.2: Mean pasture growth (kg DM/ha/day) for site 1 (Canterbury) and site 2 (Waikato). LSD is Least Significant Difference. Treatments within a date-site with differing letters are significantly different ($P < 0.05$).

	Sampling date	Day	Treatment	Mower Pasture Growth (kg DM/ha/day)	Probed/plated Pasture Growth (kg DM/ha/day)
Site 1 (Canterbury)	26/09/07	21	Control	56 a	46 ab
			40kg/ha Urea	61 ab	53 ab
			80kg/ha Urea	64 b	59 b
			40kg/ha Urea + 3L/ha LessN	61 ab	50 ab
			3L/ha LessN	59 ab	39 a
			LSD 5%	8	17
	03/10/07	28	Control	50 a	39 a
			40kg/ha Urea	59 bc	49 a
			80kg/ha Urea	62 b	44 a
			40kg/ha Urea + 3L/ha LessN	58 bc	47 a
			3L/ha LessN	54 ac	47 a
LSD 5%			7	15	
Site 2 (Waikato)	27/09/07	21	Control	58 ac	63 a
			40kg/ha Urea	56 a	81 ac
			80kg/ha Urea	71 b	107 b
			40kg/ha Urea + 3L/ha LessN	65 bc	99 bc
			3L/ha LessN	63 abc	77 a
			LSD 5%	9	22
	04/10/07	28	Control	64 a	65 a
			40kg/ha Urea	73 abc	79 abc
			80kg/ha Urea	84 b	89 bc
			40kg/ha Urea + 3L/ha LessN	76 bc	90 b
			3L/ha LessN	69 ac	75 ac
LSD 5%			12	15	

Note: There was a poor relationship ($r^2 = 0.19$) between the actual and estimated pasture growth rates reported for site 2 (Waikato) on day 21. The actual pasture growth rates are taken from the mower yields, the estimated pasture growth rates are taken via the probe or plate data. The day 21 estimates rely on the estimates of residuals after trimming on day 1.

The possible reasons for a poor relationship are:

- Variable pasture cover and significant % bare ground. Figure 5.2 illustrates pasture conditions on day 1 in trimmed area.
- Heavy rolling was undertaken on day 1 to restore surface after pugging damage, this may have resulted in an underestimate of trimmed residual, leading on day 21 to an overestimate of pasture growth rate. Therefore, the author suggests that extreme caution is required and the readers place more emphasis on the pasture growth values calculated from mower cut yields than from estimated pasture plate/probe measurements, especially with respect to site 2 (Waikato) day 21.

Figure 5.2: Photo of trimmed area at site 1 (Waikato) on day 1 of trial.

5.3 Pasture Composition

Pasture composition results for both sites are shown in table 5.3.

Table 5.3: Mean pasture composition for site 1 (Canterbury) and site 2 (Waikato). LSD is Least Significant Difference. Treatments within a date and site with differing letters are significantly different (P<0.05).

	Sampling Date	Day	Treatment	Green Leaf %	Clover %	Dead %	Weed %
Site 1 (Canterbury)	05/09/07	1	Control	77 a	16 b	5 ab	2 a
			40kg/ha Urea	77 a	16 b	6 ab	1 a
			80kg/ha Urea	78 a	15 ab	5 ab	2 a
			40kg/ha Urea + 3L/ha LessN	81 a	10 a	7 b	2 a
			3L/ha LessN	81 a	14 ab	4 a	1 a
			LSD (5%)	6	6	3	5
	26/09/07	21	Control	77 ab	13 ab	5 ab	5 a
			40kg/ha Urea	67 a	19 b	3 a	2 a
			80kg/ha Urea	81 b	10 ab	5 ab	4 a
			40kg/ha Urea + 3L/ha LessN	77 ab	15 ab	5 ab	3 a
			3L/ha LessN	83 b	8 a	6 b	4 a
			LSD (5%)	12	11	3	4
	03/10/07	28	Control	76 a	14 a	7 ab	3 a
			40kg/ha Urea	79 a	12 a	7 ab	2 a
			80kg/ha Urea	81 a	10 a	4 a	5 a
40kg/ha Urea + 3L/ha LessN			77 a	13 a	8 b	2 a	
3L/ha LessN			77 a	15 a	7 ab	1 a	
LSD (5%)			11	10	4	5	
Site 2 (Waikato)	06/09/07	1	Control	83 a	16 b	1 a	1 a
			40kg/ha Urea	86 a	12 ab	1 a	1 a
			80kg/ha Urea	88 a	8 a	3 c	0 a
			40kg/ha Urea + 3L/ha LessN	87 a	10 a	2 b	0 a
			3L/ha LessN	86 a	9 a	3 c	2 a
			LSD (5%)	7	6	1	3
	27/09/07	21	Control	82 a	16 a	2 b	0 a
			40kg/ha Urea	80 a	18 a	1 a	1 b
			80kg/ha Urea	86 a	12 a	1 a	1 b
			40kg/ha Urea + 3L/ha LessN	88 a	11 a	1 a	0 a
			3L/ha LessN	81 a	17 a	1 a	0 a
			LSD (5%)	9	8	1	1
	04/10/07	28	Control	82 a	14 a	3 b	0 a
			40kg/ha Urea	78 a	17 a	3 b	0 a
			80kg/ha Urea	78 a	20 a	2 a	0 a
40kg/ha Urea + 3L/ha LessN			75 a	20 a	2 a	3 b	
3L/ha LessN			83 a	13 a	2 a	2 ab	
LSD (5%)			13	12	1	3	