The evaluation of EMNZ Microbial products on the yield and composition of irrigated pasture

Field Report (2021/2022)

Trial aim:

1. To evaluate the effect that a range of EMNZ Microbial products has on irrigated Canterbury pastures and how they compare to traditional Nitrogen (urea) applications.

2. Three aspect of pasture performance was evaluated:

    a. Dry matter yield (kgDM/ha)
    b. Clover content within the pasture sward
    c. Root mass of the pasture

Treatments:

Treatment	Product	Rate	Application type
1	Control	-	N/A
2	Urea Full rate	80kg/ha	Applied as a liquid
3	Urea Half Rate	40kg/ha	Applied as a liquid
4	EM Soil and Crop	20L/ha	Applied as a liquid
5	EM Soil and Crop with half rate of Urea*	20L + 40kg/ha	Applied as a liquid
6	EM Plant Stimulant	1L/ha	Applied as a liquid
7	EM Plant Stimulant with half rate of Urea*	1L + 40kg/ha	Applied as a liquid
8	EM Fert Enhance	10kg/ha	Applied as a solid
9	EM Fert Enhance with half rate Urea*	10kg + 40kg/ha	Applied as a solid

*all Urea applications made as a liquid (dissolved and sprayed on)

Trial location:

Lance Field
Edwards Road
Rolleston
Canterbury

GPS: -43.635089, 172.361077

Trial methodology:

The trial was conducted on a high performing commercial irrigated pastoral farm in central Canterbury.

The trial was set out in a randomised complete block design, containing six replicates of each treatment. Each individual plot was 7.5m x 3m (22.5m²).

Prior to the first application of the products, the trial area was mown off using a ride-on mower to ensure all plots were starting from the same height (yield) at the start of the trial. This process was conducted after every harvest event, prior to the next treatment application. Treatments were left for 5-7 days to 'freshen' before treatments were re-applied.

Liquid treatments were applied using a knapsack CO_2 sprayer incorporating three Hardi MD02 air induction flat fan nozzles at an application pressure of 280 kPa on a boom with 50cm spacing's. A water rate of approximately 200L/ha was used.

Solid treatment applications were made by hand, evenly distributing the product over the entire plot area.

Harvest frequency was dictated by the yield of the pasture, with harvest being conducted when the trial reached approximately 2,500 – 3,000 kgDM/ha.

Dry matter yields were assessed by mowing a single strip up the length of each plot using a commercial rotary lawn mower. The mowing strip was approximately 50cm wide.

Sub samples (approx. 200g) of the mown pasture from each plot was collected, weighed, dried down in a commercial drying oven and reweighed to calculate the dry matter % of each plot. Total yields were then calculated out to kgDM/ha from the mown strips.

White Clover content was assessed by counting the number of plants (trifoliate leaves) within a quadrat (1m²) area. 3 random quadrat assessments were taken per plot. Two assessments were conducted – December 2021 and April 2022.

Root mass was assessed by digging 3 random 'spade squares' per plot. The dirt/pasture was moved to a lab where the above ground plant material was removed, and the dirt washed away. The remaining root material was then dried down to remove moisture and weighed. One assessment was conducted – at the completion of the trial (April 2022).

The first applications for each trial were made in mid-September 2021 and the last in mid-March 2022. In total, 5 treatment applications were made throughout the trial period, with 5 harvests being conducted.

Figure 1 - Trial site – September 2021

Results

Dry matter Yield (kgDM/ha)

Similar trends were seen across all harvest dates, with the high rate of Urea (80 kg/ha) consistently producing the highest yield. While the yield was not always significantly greater than the other treatments, it consistently produced the highest yield (Table 1).

EM Soil & Crop + urea (40) and EM Plant Stimulant + urea (40), also produced consistently high results across all harvests compared to other treatments. EM Plant Stimulant + urea (40) and Urea Full (80) are the only two treatments that had significantly greater yield than the control at every single harvest.

When looking at the combined total dry matter yield grown over the entire trial period (Table 2), all treatments except EM Soil & Crop (20) grew significantly more total yield than Control.

Urea Full (80) grew the highest amount of dry matter, but this was significantly similar to that grown by EM Soil & Crop + urea (40), EM Plant Stimulant + urea (40), and EM Fert Enhance + urea (40).

The addition of EM Soil & Crop, EM Plant Stimulant, and EM Fert Enhance to urea (40) significantly increased total dry matter production compared to urea (40) alone or the EM products alone. This indicates these products are enhanced when small amounts of nitrogen are added to them.

Table 1. Mean dry matter yield (kgDM/ha) by harvest

Treatment	19-Oct-21		9-Dec-21		6-Jan-22		17-Mar-22		21-Apr-22	
Control	2566	e	1912	e	2145	d	2705	c	2408	c
Urea Full (80)	2965	ab	2395	ab	2640	a	3447	a	3207	a
Urea Half (40)	2724	cde	2234	bc	2412	b	3062	abc	2586	abc
EM Soil & Crop (20)	2640	de	2007	de	2242	cd	2804	bc	2536	bc
EM Soil & Crop (20) + urea (40)	2965	ab	2444	a	2724	a	3081	abc	2896	abc
EM Plant Stimulant (1)	2797	bcd	2248	bc	2391	bc	2745	c	2964	abc
EM Plant Stimulant (1) + urea (40)	2973	ab	2392	ab	2640	a	3331	ab	3153	ab
EM Fert Enhance (10)	2848	bc	2122	cd	2265	bcd	3048	abc	2884	abc
EM Fert Enhance (10) + urea (40)	3045	a	2488	a	2615	a	3070	abc	2933	abc
CV%	5.6		6.9		5.4		16.4		19.8	
LSD 5%	184		180		155		584		653	
F prob.	0.000		0.000		0.000		0.153		0.206	

Means followed by the same letter do not significantly differ (P>0.05)

Table 2. Combined total dry matter yield (kgDM/ha) grown over trial period date (Sept 2021 – Apr 2022)

Treatment	Total	
Control	11668	d
Urea Full (80)	14665	a
Urea Half (40)	13134	bc
EM Soil & Crop (20)	12340	cd
EM Soil & Crop (20) + urea (40)	14242	a
EM Plant Stimulant (1)	13117	bc
EM Plant Stimulant (1) + urea (40)	14389	a
EM Fert Enhance (10)	12951	c
EM Fert Enhance (10) + urea (40)	14034	ab
CV%	6.6	
LSD 5%	1036	
F prob.	0.000	

Means followed by the same letter do not significantly differ (P>0.05)

Clover Content

There were some clear treatment effects on Clover Content within the pasture sward. As expected, the high rate of urea (80) reduced clover content at both assessment dates. This is often seen in high nitrogen use systems. The low nitrogen rate (urea 40) had no effect on clover content (Table 3).

At the first assessment date, EM Soil and Crop and EM Plant Stimulant significantly increased clover content compared to untreated control and compared to both urea alone treatments. At the second assessment date a similar result was seen, although EM Plant Stimulant had similar clover content to untreated.

At the first assessment date, EM Fert Enhance did increase clover content compared to untreated, but this was not statistically significant. It did however significantly increase clover content compared to the urea only treatments. A similar result was seen at the second assessment date, but the increased clover content was seen only against the high rate of urea.

The addition of 40kg/ha Urea to the three EM products did reduce clover content but not statistically.

Table 3. Clover content per treatment by assessment date

Treatment	9-Dec-21		21-Apr-22	
Control	69	cd	39	bc
Urea Full (80)	51	e	25	d
Urea Half (40)	65	d	35	cd
EM Soil & Crop (20)	88	a	52	a
EM Soil & Crop (20) + urea (40)	78	abc	45	abc
EM Plant Stimulant (1)	82	ab	47	ab
EM Plant Stimulant (1) + urea (40)	77	abcd	46	abc
EM Fert Enhance (10)	78	abc	46	abc
EM Fert Enhance (10) + urea (40)	71	bcd	43	abc
CV%	14.0		23.9	
LSD 5%	12		12	
F prob.	0.000		0.002	

Means followed by the same letter do not significantly differ (P>0.05)

Root Mass

Despite the obvious differences in dry matter production between treatments, there were little significant differences in Root Mass between treatments. All treatments had similar root mass to untreated, with the one exception being EM Plant Stimulant. This treatment had significantly greater root mass than the Untreated.

Table 4. Root mass (g) by treatment at the completion of the trial (April 2022)

Treatment	21-Apr-22	
Control	149	b
Urea Full (80)	186	ab
Urea Half (40)	177	ab
EM Soil & Crop (20)	186	ab
EM Soil & Crop (20) + urea (40)	171	ab
EM Plant Stimulant (1)	211	a
EM Plant Stimulant (1) + urea (40)	168	ab
EM Fert Enhance (10)	179	ab
EM Fert Enhance (10) + urea (40)	185	ab
CV%	23.2	
LSD 5%	48	
F prob.	0.465	

Means followed by the same letter do not significantly differ (P>0.05)

Conclusion

All three EM products showed that they have a positive effect on pasture production. While on their own the level of dry matter production was lower than that of high rates of nitrogen, in combination with lower rates of nitrogen they provide significant benefits.

The total dry matter produced by combining each of the three EM products with 40kg urea/ha, was equivalent to that grown by applying 80kg urea/ha. This means that farmers can reduce their nitrogen inputs, but can grow equivalent amounts of pasture by adding in one of the EM products. This has significant production, economic and environmental benefits.

The increased level of clover being able to be produced by implementing the above system, compared to high nitrogen systems, will also be a long-term benefit for pastoral farmers.

Principal Investigator: Nigel Johnston
Pasture First Research Ltd.

Pasture First Research Ltd
Innovation Park
185 Kirk Road
Templeton
Christchurch
New Zealand

M. +64 27 777 2877
E. nigel@pasturefirst.co.nz
W. www.pasturefirst.co.nz