Bega Nitrogen Use Efficiency Trial 2015/16

Cut Report 1 – 2015/16 Kikuyu season

27th November 2015 – 1st April 2016

Key Messages

- Nitrogen application to kikuyu can be profitable if the extra feed produced can be effectively utilized by the milking herd
- Nitrogen application improved forage quality by about 0.5 MJ ME/kg DM and increased the total MJ ME/ha produced by 20 - 30%
- Increasing kikuyu production and improving feed quality by nitrogen application, tight grazing/ harvest rotations, residue management and effective irrigation can potentially increase milk production from kikuyu by 25 – 35%
- The cost of additional feed produced was $150 – 200 t DM and a potential return of $3 to $5 per dollar spent on nitrogen was estimated for the kikuyu season

Background

The Manning nitrogen rate trial was established at James Neal's dairy, Oxley Island, in December 2014. The Bega satellite site was established at Sue and Angus Johnston's dairy, Morans Crossing via Bemboka, in a well established, fertile, irrigated kikuyu pasture in November 2015.

The objective of the trial is to establish three nitrogen regimes over the kikuyu growing season: very deficient (0 kg N/ha), deficient (150 kg N/ha) and adequate for high production (300 kg N/ha) and to then compare the effect of these treatments on ryegrass establishment and growth after the kikuyu growing season.

The site had adequate phosphorus (P), potassium (K) and sulphur (S) after a history of use as a night paddock and feed out area. White clover was removed by herbicides to improve nitrogen uniformity over the trial period and this also removed broadleaf weeds. Cows were excluded from the area by electric fence.

Treatments

The three nitrogen treatments (0, 150, 300 kg N/ha/season) were commenced 27th November 2015 after the trial area had been cleaned up by slashing and mowing to remove residual pasture. Nitrogen was applied in the form of urea granules at commencement and then after every second grazing at rates of 0, 50, 100 kg N/ha.

The plots were harvested when the kikuyu reached the 4.5 leaf stage with 6 harvests in the growing season. The harvests were taken by the plot mower leaving a residue of 5 cm and all material was removed from the plots following harvest.

Samples from all 64 plots were weighed and sub samples taken for drying in an oven at 60^{o}C for 2 days. Dried samples were sent to the Feed Quality Service at Wagga Wagga for analysis for nitrogen, nitrate and feed quality (ME, CP and NDF).

Rainfall for the growing season was 334 mm but most of this fell in December and January (about 300 mm). Irrigation was used to supplement rainfall in February and March to maintain soil moisture at close to optimal levels for plant growth. Soil moisture is being monitored with an MEA Plexus soil moisture monitoring system.

Results and discussion

Results have not been analysed statistically so the following comments are made on general observation of the averages of four replications.

Dry Matter Harvests

	Dry Matter yield (kg DM/ha) and NUE (kg DM/kg N/ha)		
N Rate (kg N/ha)	0	150	300
24/12/2015	1184	1538	1800
12/1/2016	1202	1401 (11.1)	1463 (8.8)
28/1/2016	960	1273	1313
15/2/2016	1002	1295 (12.2)	1456 (8)
7/3/2016	1305	1549	1627
1/4/2016	1704	1831 (5)	1878 (3.3)
Total DM harvested	7425	8910 (9.9)	9585 (7.2)
Ave Growth Rate (kg DM/ha/day)	55	66	71

The nitrogen response of 5 – 12 kg DM/ha per kg of N applied was lower than the potential of 20 – 25 kg DM/ha anticipated based on historic data for irrigated kikuyu, the response in the last 2 harvests was reduced due to dry conditions and less than optimum irrigation during this period.

Although the responses were lower than expected they were still economic if the increased production was converted efficiently into milk.

	0N	**150N**	**300N**
Kg DM produced	7425	8910	9585
Litres of milk	10076	12601	13629
Return $/ha	5038	6300	6814
Nitrogen cost ($650/t urea)		212	424
Profit		1050	1352
Assume 1 litre of milk produced for every 7 MJ ME and milk price of 50 c/l			

Feed quality

	Metabolisable energy MJ/kg DM			**Crude protein %**			**NDF %**		
N rate Kg N/ha	0	150	300	0	150	300	0	150	300
24/12/2015	9	9.4	9.4	20.7	21.6	22.1	59.3	58	58
12/1/2016	9.8	10	10.1	22.1	22.8	23.4	58	56.8	55.8
28/1/2016	9.5	10.1	10.2	22.1	25.2	27.0	57.8	56.3	55.8
15/2/2016	9.7	10	10	21.5	22.5	24	58	57.8	57.5
7/3/2016	9.3	9.8	10.2	21.4	24.9	25.9	59	58.3	56
1/4/2016	9.6	10	10	22.9	24.2	25.4	56.8	55.3	56
Average	9.5	9.9	10	21.8	23.5	24.6	58	57	56.5

Forage quality improved with nitrogen application in each harvest for both ME and CP, forage quality was good with ME around average (9.5 MJ ME/kg DM for kikuyu leaf) for the zero treatment and about 0.5 MJ ME/kg DM higher with nitrogen.

The nitrogen treatments increased the protein levels of the kikuyu as expected.

Leaf nitrate and Nitrogen %

	Leaf nitrate			Leaf nitrogen %		
N rate Kg N/ha	0	150	300	0	150	300
24/12/2015	176	266	505	3.3	3.5	3.5
12/1/2016	124	206	207	3.5	3.6	3.7
28/1/2016	78	671	1643	3.5	4.0	4.3
15/2/2016	37	151	359	3.4	3.6	3.8
7/3/2016	151	737	2009	3.4	4.0	4.1
1/4/2016	460	1776	2567	3.7	3.9	4.1
Average	171	635	1215	3.5	3.8	3.9

Leaf nitrate levels were variable between harvests, levels were higher as more nitrogen was applied and there appears to be a trend of nitrate accumulating across the season. The Nitrate-nitrogen content above which nitrate may be hazardous to ruminants is about 2100 mg/kg (McKenzie 2012) and this content was exceeded sometimes on the high nitrogen treatment particularly later in the season.

Significant amounts of nitrogen were removed in the harvested material – 260 kg from the 0 treatment, 335 kg from the 150 kg N and 377 kg from the 300 kg N treatment.