



Tow and Fert Grassland Foliar Feeding Trial 2016

Confidential Report for Tow and Farm

July 2016

Authors: Dr Peter Shipton and Emma Wright

All material in this Report is the Copyright of Kingshay. The results in this Report may be used by Tow and Farm for publicity or other purposes, provided that all material of whatever nature is agreed in writing with Kingshay before being issued and provided that the source of all information is stated as: "Source: Kingshay".

Contents

TRIAL OBJECTIVE	1
Materials and methods	1
Trial site – East Meade, Bridge Farm.....	1
Field history.....	1
Trial description.....	1
Table 1. Application rates of trial treatments	1
Table 2. Trial schedule.....	1
Trial layout.....	1
Tow and Fert equipment setup	1
Trial conditions.....	1
Table 3. Weather data for the period from first application until first harvest	1
Table 4. Weather data for the period from second application until second harvest	1
Field measurements.....	2
Results analysis.....	2
Results - First Harvest	3
Figure 1. Dry matter yields – First harvest. Tow and Farm grassland foliar feeding trial 2016	3
Table 5. Crop Yield, First harvest. Tow and Farm grassland foliar feeding trial 2016.....	3
Table 6. Laboratory analysis for quality – First harvest. Tow and Farm grassland foliar feeding trial 2016.....	3
Results - Second Harvest	4
Figure 2. Dry matter yields – Second harvest. Tow and Farm grassland foliar feeding trial 2016	4
Table 7. Crop Yields, Second harvest. Tow and Farm grassland foliar feeding trial 2016	4
Table 8. Laboratory analysis for quality – Second harvest. Tow and Farm grassland foliar feeding trial 2016.....	4
Discussion	5
Yield.....	5
Grass quality.....	5
Environmental implications.....	5
Limitations.....	5
Further research.....	5
Appendices	7

Disclaimer:

The Protocol followed by Kingshay for the study was that considered most appropriate to the technical knowledge and practical conditions at that time and was designed to reflect farming practice.

All results and interpretations reported are specific to the crop, livestock or machinery described in the report and also to the conditions which prevailed during the study.

Kingshay can take no responsibility for the consequences of actions carried out as a result of this report.

All rights reserved. All information produced by Kingshay in this report is copyright and is not to be reproduced, stored or transmitted in any form or distributed to other persons without written permission of Kingshay

Kingshay, Bridge Farm, West Bradley, Glastonbury, Somerset BA6 8LU

Telephone (01458) 851555 Fax (01458) 851444

Email: contact.us@kingshay.co.uk

Website: www.kingshay.com



Tow and Fert grassland foliar feeding trial 2016

TRIAL OBJECTIVE

To determine whether a reduced rate of urea can be used when applied as a foliar feed to achieve the same grass yield as urea applied as a prilled product at a standard rate, in a rotational grazing system.

Materials and methods

Trial site – East Meade, Bridge Farm

- Soil Type – Clay loam
- Altitude – 21m
- Aspect – Level
- Average annual rainfall – 800mm (31.7")

Field history

- Soil analysis: pH 6.9 P:K:Mg index 3 : 2- : 3
- Long term perennial ryegrass ley established in 2003
- Trial undertaken after the paddock was grazed for the second time that year
- 124kg/ha (product) ammonium nitrate was applied in March

Trial description

On a control section of the trial site, prilled urea was applied at a rate of 75kg/ha using a broadcast fertiliser spreader. Tow and Fert Multi 1000 was used to apply urea in aqueous solution onto the grass ley at three different application rates: 100% of the control rate, 66% of the control rate, and 33% of the control rate. These application rates are expressed as kg of product and kg of nitrogen per hectare in Table 1 below.

Table 1. Application rates of trial treatments

Treatment	kg of product/ha	kg N/ha
Control	75	34.5
33% foliar	25	11.5
66% foliar	50	23.0
100% foliar	75	34.5

3 weeks after these applications, sections from each plot were mowed, weighed and sampled for laboratory analysis, and the Bridge Farm milking herd grazed the entire paddock down to grass covers of 1,700kgDM/ha, as part of their grazing rotation.

After this first grazing, the urea applications were repeated in the same plots, and sampled in the same manner after a second 3 weeks.

The dates of the events above are displayed in Table 2.

Table 2. Trial schedule

Date	Event
30 th April	First urea applications on grazed residuals of 1,700kgDM/ha
24 th May	First harvest sampled and grazed
31 st May	Second urea applications on grazed residuals of 1,700kgDM/ha
21 st June	Second harvest sampled and grazed

Trial layout

Length 300m	Control – prilled urea 75kg/ha product	Tow and Fert foliar aqueous urea 25kg/ha product	Tow and Fert applied urea 50kg/ha product	Tow and Fert applied urea 75kg/ha product
	Width 36m	Width 32m	Width 32m	Width 32m

Tow and Fert equipment setup

The equipment was set up as demonstrated by representatives of Tow and Farm previously. The urea and water mix was calculated by use of the Tow and Fert Mix Optimisation Software supplied with the equipment. See Appendix 1 for the print out from this software.

Trial conditions

Urea applications were made in cloudy, dry weather, ahead of a minimum 12-hour dry period.

Table 3. Weather data for the period from first application until first harvest

	Maximum daily	Average daily	Minimum daily	Total for the period
Max Temperature	23 °C	17 °C	13 °C	
Mean Temperature	18 °C	12 °C	6 °C	
Min Temperature	14 °C	7 °C	-1 °C	
Precipitation	29.0mm	1.9mm	0mm	45.97mm
Wind	37km/h	12 km/h	0 km/h	
Gust wind	53 km/h	44 km/h	34 km/h	

Table 4. Weather data for the period from second application until second harvest

	Maximum daily	Average daily	Minimum daily	Total for the period
Max Temperature	24 °C	19 °C	15 °C	
Mean Temperature	19 °C	16 °C	12 °C	
Min Temperature	14 °C	11°C	7 °C	
Precipitation	15.0mm	2.4mm	0mm	51.83mm
Wind	34km/h	10 km/h	0 km/h	
Gust wind	57 km/h	37 km/h	37 km/h	

Field measurements

The following measurements were made for each treatment:

- Freshweight yield
- Dry matter content (DM)
- Crude protein (CP)
- Digestibility (D value)
- Ruminant metabolisable energy (ME)
- Neutral detergent fibre (NDF)
- Nitrate nitrogen (% of total nitrogen)

Results analysis

Results of the trial have been subjected to a statistical analysis of variance (ANOVA). Results are presented as:

- Standard Error of the Mean (SEM). The standard deviation of the error in the sample mean relative to the true mean.
- Significance probability (p) at the $p = 0.05$ level (95%) i.e. levels of $p < 0.05$ indicate that the differences between treatments are statistically significant.
- Least Significant Difference (LSD). The minimum difference between treatments needed before the difference is statistically significant.

Results - First Harvest

Figure 1. Dry matter yields – First harvest. Tow and Farm grassland foliar feeding trial 2016

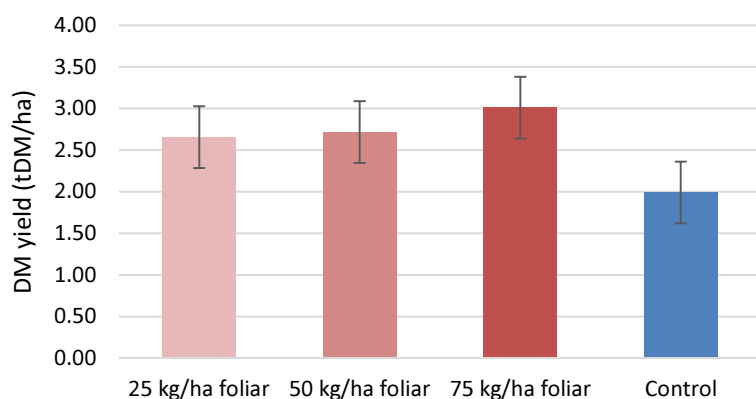


Table 5. Crop Yield, First harvest. Tow and Farm grassland foliar feeding trial 2016

Treatment	Fresh Yield (t/ha)	Dry Matter (%)	Dry Matter Yield (t DM/ha)
Control	9.63	20.76	1.99
25kg/ha foliar	14.43	18.35	2.66
50kg/ha foliar	14.61	18.59	2.72
75kg/ha foliar	16.88	17.87	3.01
SEM	0.910	0.418	0.14
Significance (p=0.05)	0.017	0.047	0.068
LSD	3.796	1.998	0.742

Values in bold are significantly different from control

Table 6. Laboratory analysis for quality – First harvest. Tow and Farm grassland foliar feeding trial 2016

	25 kg/ha foliar	50 kg/ha foliar	75 kg/ha foliar	Control
DM%	18.35	18.59	17.87	20.76
CP%	16.49	19.39	14.42	14.35
D value	72.83	72.51	71.13	71.71
NDF%	40.96	38.47	47.57	41.43
Sugars%	15.16	12.92	14.57	17.03
ME (MJ/kgDM)	11.43	11.38	11.17	11.26
Nitrate nitrogen (% total nitrogen)	0.13	0.17	0.11	0.10

All parameters are expressed on a dry matter basis apart from dry matter itself and D value.

Results - Second Harvest

Figure 2. Dry matter yields – Second harvest. Tow and Farm grassland foliar feeding trial 2016

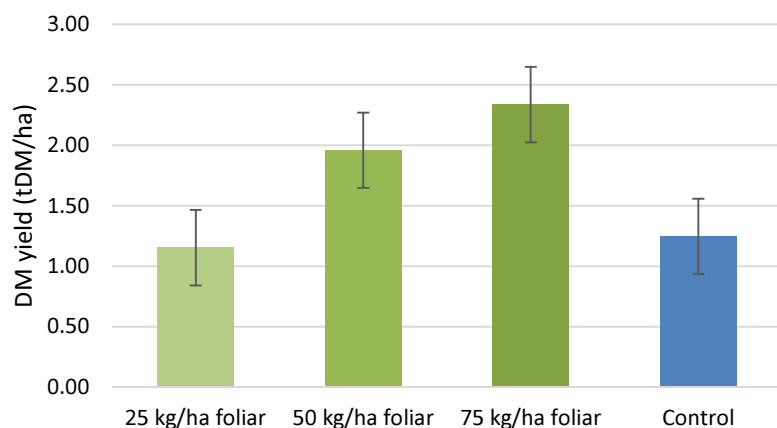


Table 7. Crop Yields, Second harvest. Tow and Farm grassland foliar feeding trial 2016

Treatment	Fresh Yield (t/ha)	Dry Matter (%)	Dry Matter Yield (t DM/ha)
Control	7.3	17.1	1.25
25kg/ha foliar	6.1	18.9	1.15
50kg/ha foliar	11.8	16.8	1.96
75kg/ha foliar	15.1	15.5	2.34
SEM	1.18	0.455	0.163
Significance (p=0.05)	0.006	0.009	0.065
LSD	4.16	2.41	0.62

Values in bold are significantly different from control

Table 8. Laboratory analysis for quality – Second harvest. Tow and Farm grassland foliar feeding trial 2016

	25 kg/ha foliar	50 kg/ha foliar	75 kg/ha foliar	Control
Dry matter%	18.9	16.8	15.5	17.1
Crude protein%	18.8	24.0	22.0	21.8
D value	69.5	67.8	68.6	69.2
NDF%	47.5	51.4	49.7	49.0
Sugar%	10.8	5.59	6.04	7.15
ME MJ/kg	10.9	10.6	10.8	10.9
Nitrate nitrogen (% total nitrogen)	0.13	0.13	0.13	0.12

All parameters are expressed on a dry matter basis apart from dry matter itself and D value.

Discussion

Yield

After both first and second fertiliser applications, the 75kg/ha and 50kg/ha foliar urea application rate plots produced significantly higher freshweight and dry matter yields than the control prilled application plot, which received the same urea application rate.

The data suggests that a reduced rate of urea application can be used as an aqueous foliar feed to achieve similar grass yields to that of prilled urea in the trial conditions, in the order of a 33% to 50% reduction.

Grass quality

At the first harvest, the 75kg/ha foliar urea treated grass had higher NDF and lower ME, D value and sugar levels per kg dry matter, indicating more mature grass plants. This could be due to faster intake of urea into the plants, giving a quicker flush of growth. This could make foliar urea application suitable for earlier regrowth of grass in a rotational system.

Environmental implications

The increase in grass yield is likely to be due to a higher percentage of the urea applied to the pasture that was successfully taken into grass plants when applied as a foliar feed compared to the prilled product. This suggests more urea was lost to the environment when applied as a prilled application, either through volatilisation, denitrification, leaching or a combination.

Applying aqueous urea as an alternative to granular urea is a potentially effective way to reduce a farm's environmental impact through reduction of nitrate leaching.

Limitations

- After the first application and harvest, the trial area was grazed by 220 dairy cows. Dung would not have been evenly distributed over the trial area and could have therefore influenced the result.
- The different urea treatments were applied to the same plot areas on the second trial application. This could have had a cumulative effect on nitrogen applied, this effect would be expected to be greater on the prilled treatment section.
- Using prilled urea as a grassland fertiliser successfully involves specific weather conditions to minimise volatilisation. These conditions are rain in all three days after application, and low ambient temperatures (<10°C). The trial experienced much warmer, drier conditions than those ideal for prilled urea application, and one would expect results to be less dramatic in said conditions. However, local farmers were known to be using prilled urea at this time, therefore this trial offers direct comparison of an alternative application method for these producers.

Further research

Similar trials could be performed:

- under different weather conditions
- using other inorganic fertilisers, particularly ammonium nitrate which is more commonly used in the UK during the time of year this trial was undertaken.

Appendices


Appendix 1.




Appendix 2. Close-up of aqueous urea solution droplets adhering to grass leaf



Appendix 3. Example mix setup as specified by the Tow and Fert Mix Optimisation Software





Advanced Details & Setup: Hide Show

For Support with the Tow and Fert Calculator
 Phone: +64 6 374 7043
 Email: info@towandfarm.com

Speed Range

5-8 km/hr 8-12 km/hr

12-15 km/hr 15-20 km/hr

20-25 km/hr

LOADS REQUIRED

Spray Width (approx) 16 metres

Suggested Nozzles TF20

Suggested Speed 23.3 km/hr

(you can enter/edit the speed manually if necessary)

ADVANCED SETUP DETAILS

Max Volume in Tank	1050
Additional Liquid in System	50
Time to Apply Per Load	8 mins
Distance Travelled Per Load	3.25 km
Total Volume Per Load	347.55 litres
Total Weight Per Load	991 kg

PRODUCTS & APPLICATION INPUTS

Area (in Hectares) 5.2

Product Rate / Ha

X Urea 25 kg

X

X

X

X

X

PRODUCTS & APPLICATION RESULTS

Amount per mix load

Water 261 litres or kg

Product

Urea 130 kg

Fine Tuning Data for Mix Ratios per product

Ratio (Product:Liquid)

Current	Max
0.50	0.50
0.50	0.50
Combined Mix Ratio	

