Mountjoy William Hannah & family

PROJECT:
Reducing nitrogen and incorporating more clover in the swards

Key take home messages:

- Reducing total nitrogen by 50% grew only 10% less grass
- The half rate summer trial once again had a small impact on total grass growth – a 19% reduction in nitrogen use led to only a 5% reduction in grass growth

The problem:

Historically, the farm has used around 300kg of nitrogen/ha on the grazing platform. However, Will Hannah sees a valuable benefit of reducing nitrogen (N) input moving forward, being conscious of future farming policies such as the Water Resources (Control of Agricultural Pollution) (Wales) Regulations 2021, along with the nation's aim of becoming carbon neutral.

The aim of the project was to reduce nitrogen fertiliser use on the farm whilst still maintaining (or increasing) the amount of milk from forage, maintaining milk quality and high levels of animal health/performance.

The project investigated a range of fertiliser strategies (rate/timings) and sward/soil/slurry management regimes that may improve nitrogen use efficiencies.

Purpose of work:

Reducing the amount of nitrogen fertiliser applied can have a significant impact on farm profitability and have positive environmental impacts both locally (water and air quality) and globally (reduced carbon footprint).

Nitrogen remains a valuable input to grassland systems and any reduction in usage needs to be countered by increased nitrogen use efficiency to avoid significant reductions in grass production that would then increase reliance on purchased feeds or lead to a drop in farm output.

Measures to increase nitrogen use efficiency should focus on improving natural nitrogen supply (increasing soil nitrogen turnover and clover fixation), on maximising response to any applied nitrogen (promoting soil and sward health) and on limiting wastage (adopting best practices for applications of both fertilisers and manures).

What we did:

Initially from summer (1 July 2020)/early autumn (31 October 2020), normal N rates were cut by half. The trial field was split into three sections;

- Section one – Normal N application
- Section two – Half the normal N application
- Section three – No N application

Treatments will be repeated for at least three consecutive grazings and all paddocks will be measured for grass growth using a platemeter.

Variable rate trials can be repeated on other paddocks in the grazing round with different sward quality and soil types to assess the variation in N response and soil N supply.

The project initially ran during the 2020 grazing period, but was trialled again during the 2021 grazing period, looking at the potential to reduce N rates through the spring period.

Outcomes:

The trial consisted of standard rate of N for the first four grazing rounds across the whole trial area - followed by a zero rate, half rate and full rate of N for four further grazing rounds from July to October.

Impact of halving or halting nitrogen applications from July to October 2020			
	No Summer N	Half Summer N	Full N
Total N applied	80kgN/ha (before July)	119kgN/ha	158kgN/ha
Percentage of total N used in season	50%	75%	100%
Cost savings/ha July-September versus full rate N application (34.5%N@£650/t)	£147/ha (£1.88*78kgN/ha)	£73/ha (£1.88*39kgN/ha)	
Total kilos of dry matter produced across season (kg/DM/ha)	14,365kgDM/ha	15,012kgDM/ha	15,978kgDM/ha
Percentage of total dry matter production potential	90%	94%	100%

Table 1. Impact of different artificial nitrogen application rates on grass production (after initial first application in July)

LOCATION:
Haverfordwest

FARM:
Sector: Dairy

Stock numbers & breed: 390 milkers and 200 followers *(Friesian cross)*

Farm size (ha): 242ha

Woodland (ha): 7ha

Crops & ha grown: All grass

Land management schemes: None

Calving pattern/Lambing months: Late spring calving – March-June

Grazing system: Paddock

FARM OBJECTIVES

1. Reduce nitrogen (N) usage by half 250kg/ha to 125kg/ha
2. Grow as much grass per ha as previously under heavier N applications (11-12 tonne DM/ha)
3. Increase clover into the swards

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Reducing total nitrogen by 50% grew only 10% less grass – but this reduction relied on high levels of soil mineralisation and clover fixation through the summer to replace most of the bagged N. The cost saving is based on current artificial fertiliser prices and not those of 2020. The half rate showed virtually half the saving.

The use of summer nitrogen fertiliser still saw a response of over 20:1. Therefore, if there was a demand for extra autumn grass, then the use of mid/late season nitrogen still showed an economic return, even at £650/t for artificial fertiliser. The cost of the extra grass production was around 10p/kgDM (at Q2, 2022 prices) – way below purchased feed or silage costs.

Autumn soil analysis measured mineral nitrogen levels 60kgN/ha higher under the full rate than the half rate, although only 40kgN/ha was initially added. Any mineral nitrogen in the soil in late autumn is at high risk of leaching loss.

In 2021, we imposed a zero-nitrogen treatment from day 1 – and the half rate treatment again began after the first four grazings.

Impact of removing nitrogen - and of halving summer nitrogen - 2021			
	No N	Half Summer N	Full N
Total N applied	0	120kgN/ha	147kgN/ha
Percentage of total N used in season	0%	81%	100%
Total kilos of dry matter produced across season (kg/DM/ha)	8310kgDM/ha	11750kgDM/ha	12350kgDM/ha
Percentage of total dry matter production potential	67%	95%	100%

Table 2. Impact of different artificial nitrogen application rates on grass production

The cold spring of 2021 meant there was very little mineralisation or clover fixation and the zero N area was way behind the nitrogen applied plots. Up to 1 July 2021, the zero-nitrogen area grew half as much grass compared to normal applications rates circa 150kgN/ha (4,350kgDM/ha v 2,310kgDM/ha) following the initial sweep round the platform with dry cows in January.

Summer mineralisation and fixation helped the zero N plots to close the gap slightly – but they still recorded a 4tDM/ha deficit. Summer clover levels were higher in the zero N area compared to half rate plots (23%DM vs 13% DM) (from sward separation data) but sward quality protein was similar at 14%.

The half rate summer trial once again had a small impact on total grass growth – a 19% reduction in nitrogen use led to only a 5% reduction in grass growth.

As in 2020, in purely financial terms, the full rate N still provided a good return on investment compared to the half rate – with a response of 22kgDM per kgN applied.

Research into practice /10 how to steps for your farm:

1. Platemeter measure post and pre graze
2. Soil sample to assess soil nitrogen status
3. Calculate grass growth rates and tonnage grown for each grazing round.