AgriSearch NI
Driving Excellence & Innovation

cafre
College of Agriculture, Food & Rural Enterprise

Optimising Nutrient Use Efficiency

DAERA
Department of Agriculture, Environment and Rural Affairs
www.daera-ni.gov.uk

afbi AGRI-FOOD & BIOSCIENCES INSTITUTE

NIEA

Why is Nutrient Use Efficiency Important?

- Organic manures are a valuable resource
- Manufactured fertilisers have become very expensive
- Fertiliser accounts for ~20% of GHG emissions on Beacon Farms
- Lowering use of manufactured fertiliser through better use of organic manures and legumes is a win / win for the farmer and the environment

Tonight's Presentations

Aveen McMullan (CAFRE):

Improving nutrient use efficiency

Suzanne Higgins (AFBI):

Comparison of agronomic performance of different fertiliser formulations

Robert Patterson (CAFRE):

Clover Establishment

cafre
College of Agriculture, Food & Rural Enterprise

Optimising Nutrient Use Efficiency

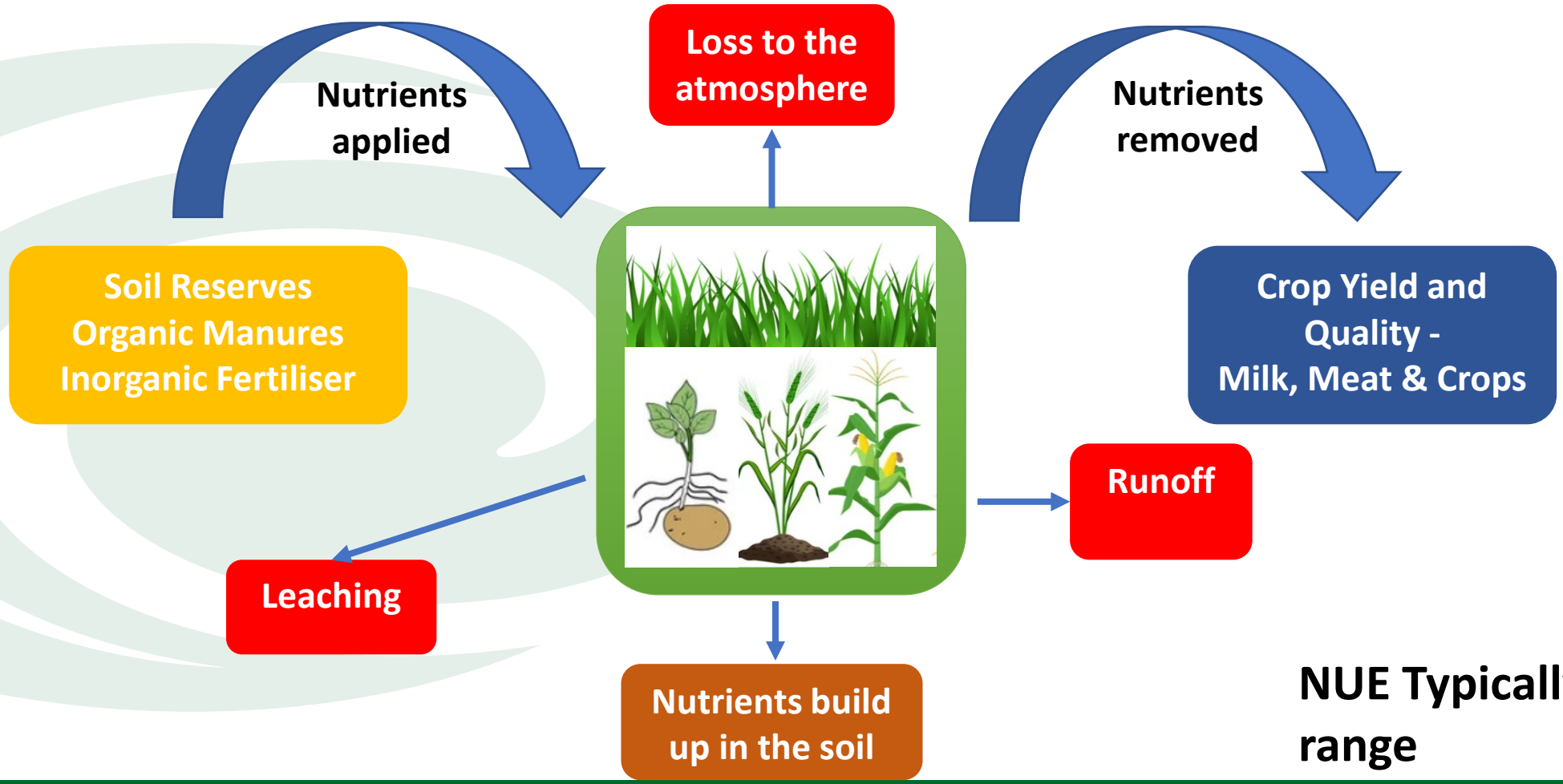
Aveen McMullan, CAFRE

27 January 2023

DAERA
Department of Agriculture, Environment and Rural Affairs
www.daera-ni.gov.uk

What is Nutrient Use Efficiency ?

cafre
College of Agriculture, Food & Rural Enterprise



NUE Typically 60% range

DAERA
Department of Agriculture, Environment and Rural Affairs
www.daera-ni.gov.uk

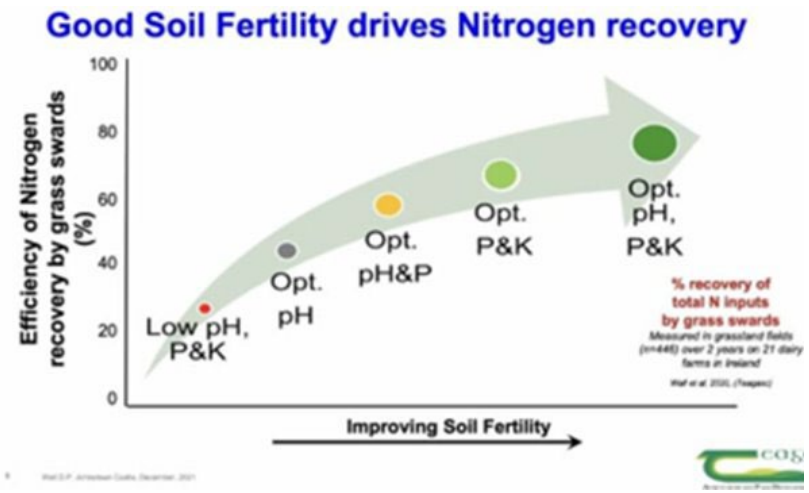
Benefits for your business

- More nutrients available to support crop and grass growth, yield and quality
- Savings on inputs
- Time and money saved
- Reduced risk of environmental damage

Actions to improve Nutrient Use Efficiency

cafre
College of Agriculture, Food & Rural Enterprise

- Build soil fertility
- Make best use of organic manures
- Incorporate cover crops and legumes
- Use precision application techniques
- Ensure accurate & effective application



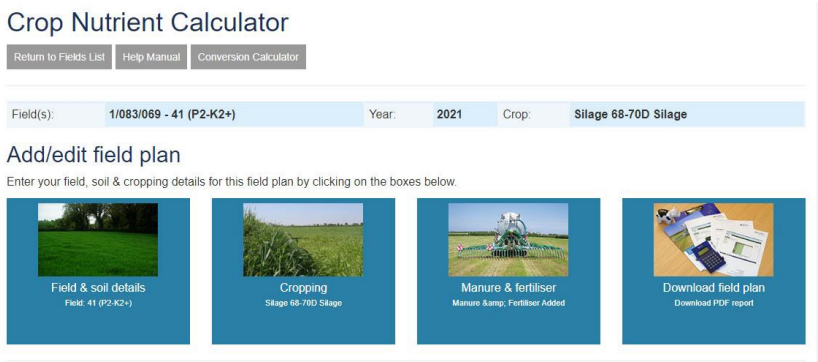
DAERA
Department of Agriculture, Environment and Rural Affairs
www.daera-ni.gov.uk

Factors effecting Nutrient Use Efficiency

cafre
College of Agriculture, Food & Rural Enterprise

Building soil fertility

- Soil test
- Nutrient Management Plan
  - CAFRE Crop Nutrient Calculator www.daera/onlineservices.gov.uk



Factors effecting Nutrient Use Efficiency

cafre
College of Agriculture, Food & Rural Enterprise

Soil Health

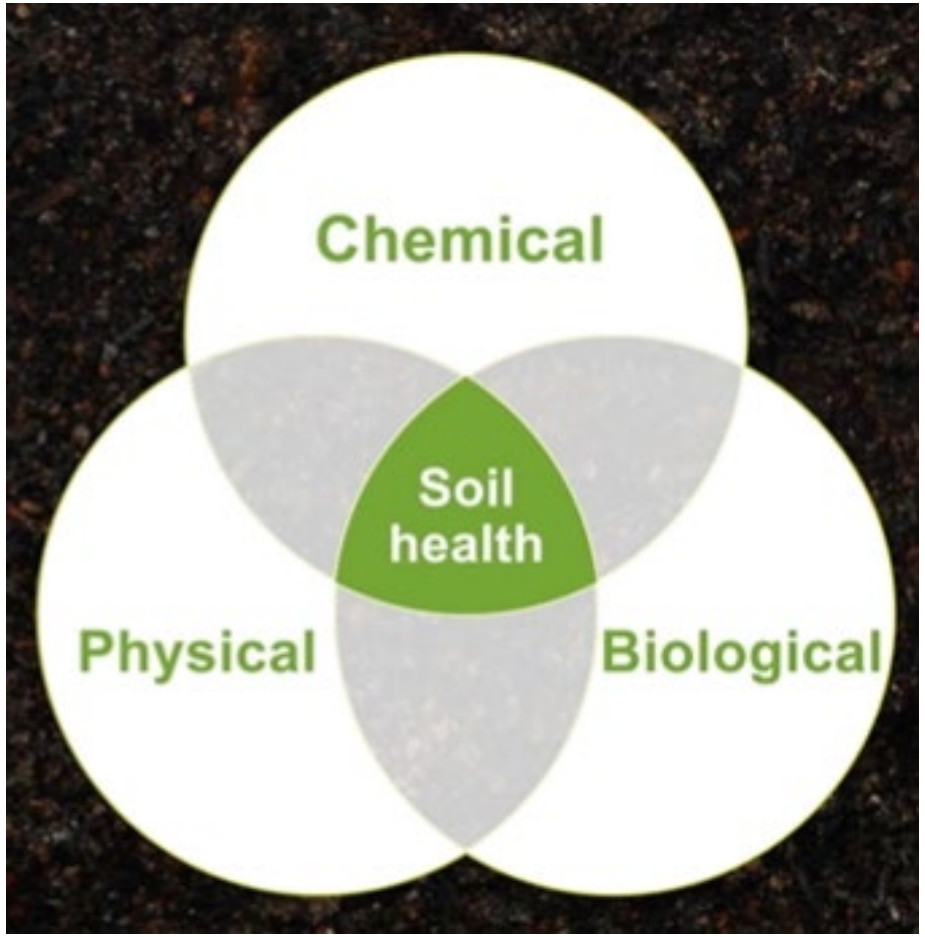
- Nutrient Use Efficiency depends on the correct functioning of the soil

pH

- Influences soil health & nutrient availability

EFFICIENCY OF UPTAKE

UTILISATION EFFICIENCY



Factors influencing uptake

- Poor soil structure
  - Compaction
  - Poor drainage

All lead to poor root development

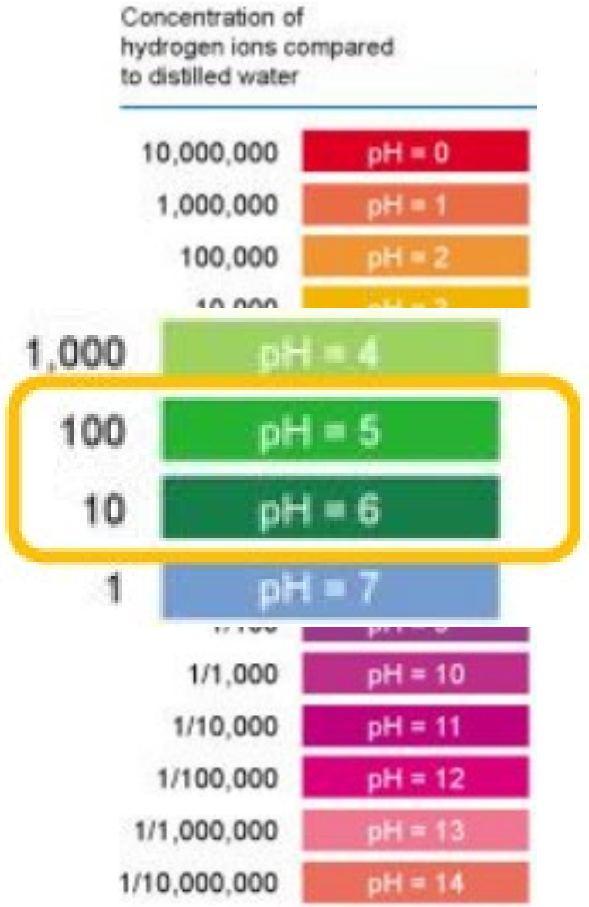
- pH
- Weather conditions

Factors influencing utilisation efficiency

cafre
College of Agriculture, Food & Rural Enterprise

pH

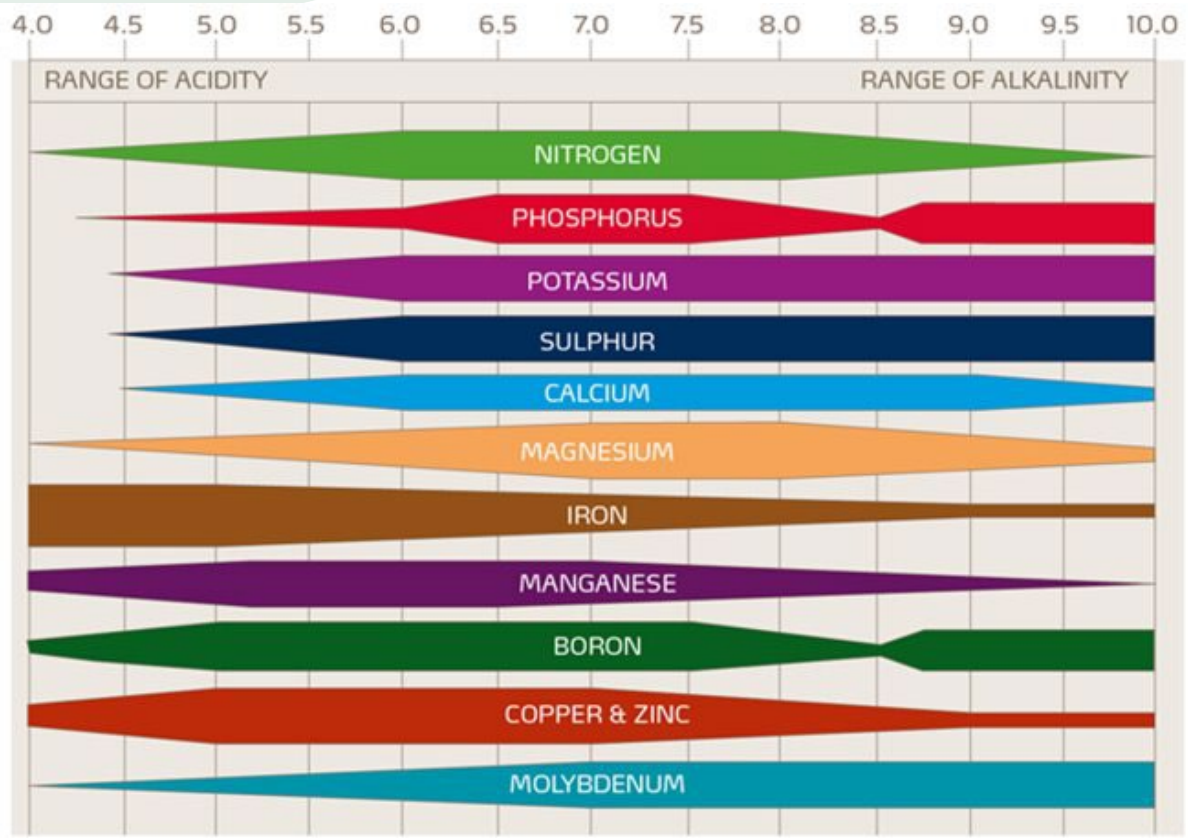
- measure of acidity
- log scale
- pH 5 - 10 times more acidic than pH 6
- not a case of close enough



Factors influencing utilisation efficiency

cafre
College of Agriculture, Food & Rural Enterprise

pH – Nutrient Availability



- Plant needs more than N, P, K
- pH influences availability of all nutrients
- Optimum pH
- Correct balance of all nutrients

DAERA
Department of Agriculture, Environment and Rural Affairs
www.daera-ni.gov.uk

Effect of Soil pH on Fertiliser Utilisation

cafre
College of Agriculture, Food & Rural Enterprise

Soil pH	Nitrogen Utilisation	Phosphorus Utilisation	Potassium Utilisation	% of Fertiliser Wasted	Potential Financial Loss (£/ha) @ £256/t	Potential Financial Loss (£/ha) @ £730/t
5.0-5.5	77%	48%	77%	32%	£45.06	£129
5.5-6.0	85%	52%	100%	21%	£29.57	£85
6.0-6.5	100%	100%	100%	0%	£0	£0

Source: Teagasc, DAERA, 2017

150kg N/Ha of 27-4-4

64% of soil samples below pH 6

DAERA
Department of Agriculture, Environment and Rural Affairs
www.daera-ni.gov.uk

Make best use of organic manures

cafre
College of Agriculture, Food & Rural Enterprise

When applying manures

- Match application to growth
- Use LESSE
- Observe buffer zones

DAERA
Department of Agriculture, Environment and Rural Affairs
www.daera-ni.gov.uk

Make best use of organic manures

cafre
College of Agriculture, Food & Rural Enterprise

- 70% Nitrogen ingested is excreted
- Grazing sward 60% Phosphate and 90% Potash is recycled
- 1 tonne silage (fresh weight) removes 1.7kg Phosphate and 6kg Potash

Make best use of organic manures

cafre
College of Agriculture, Food & Rural Enterprise

- Silage fresh weight @ 25% dry matter

Silage (fresh weight)	Phosphate (P_2O_5) removed	Potash (K_2O) removed
10 tonne/ha	17	60
15 tonne/ha	26	90
23 tonne/ha	39	138

Silage is removed completely

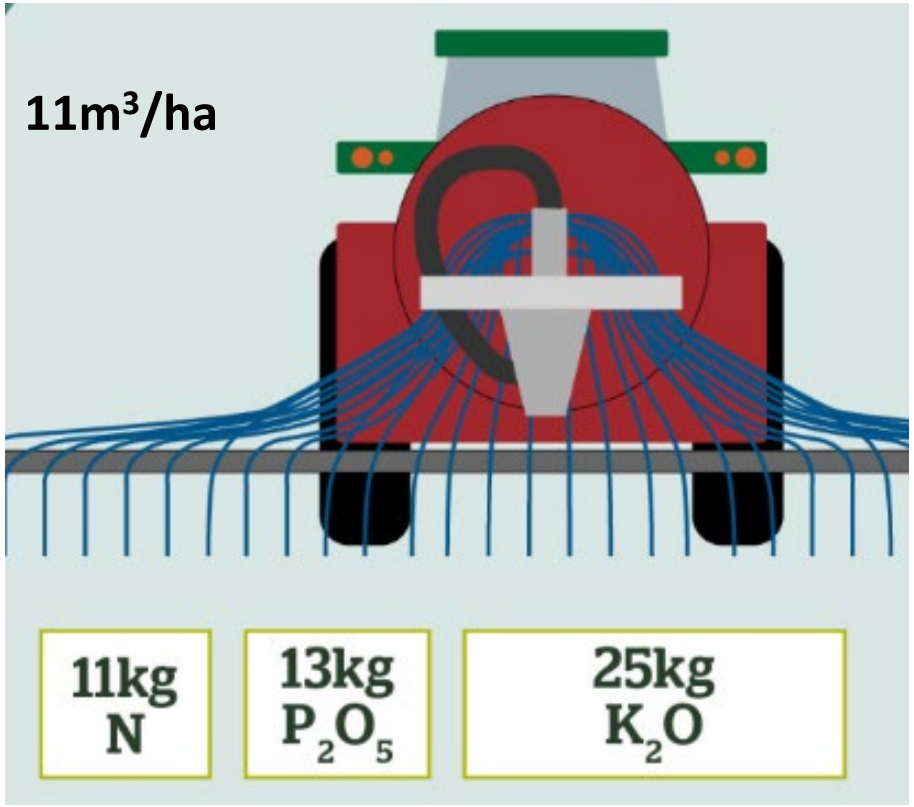
Remember to replace offtakes

Replacing offtakes

15 tonne silage (fresh weight) removes 26kg P_2O_5 and 90kg K_2O

Cattle Slurry 6% DM

- $1m^3$ contains
  - N 1.0kg
  - P_2O_5 1.2kg
  - K_2O 2.25kg (RB209)



Liquid Fertiliser

cafre
College of Agriculture, Food & Rural Enterprise

- A suspension of nutrients in liquid form
- A soil acting fertiliser
- Not a foliar feed

Foliar Fertiliser

cafre
College of Agriculture, Food & Rural Enterprise

- A liquid product added to water
- Applied to the leaves of a plant

Foliar Fertiliser

cafre
College of Agriculture, Food & Rural Enterprise

Advantages

- Good in dry conditions
- Useful for trace elements
- Applied using a conventional sprayer

Disadvantages

- Limit to quantity of nutrient can be applied in one application
- Risk of leaf scorch
- Need a leaf to uptake nutrients
- Difficult to meet K demand in grassland

Other liquid products

- Anaerobic digestate bioproducts
- Bio stimulants
- Liquid seaweed
- Humic & Fulvic acids

- **Further research is required**

cafre
College of Agriculture, Food & Rural Enterprise

Clover Establishment

Robert Patterson
Dairying technologist - CAFRE

Clover

Benefits

- Reduce reliance on Chemical Nitrogen
- Animal performance
- Environmental benefits

Aims

- Est. white clover in 1/6 of grazing platfrom
- Reduce N input & maintain grass DM/ha grown

cafre
College of Agriculture, Food & Rural Enterprise

Establishing Clover

- Soil temperature
- Soil moisture
- Timing – daylight hours
- Minimise weed competition
- Field specific plan – Nutrients Action Plan
- Record fertiliser use and grass growth

Selection process

- Soil pH status
- Soil P & K Indices
- Prevalence of weeds in the existing sward
- History of sprays applied
- Performance of existing sward
- Amount of Nitrogen kg/ha received so far

Establishment Method

1. Remove grass DM
2. Sowing the seed asap
3. Minimal soil disturbance
4. Broadcast seeding – 2.5 kg/ac
5. Prilled lime and MOP (0-0-60) applied
6. Close gate

Sward post pre-mowing and grazing

10 days post sowing

Post Sowing Management

- Graze 18 – 21 days post sowing (2,600 Kg DM/ha)
- Tight grazing's (1,500 Kg DM/ha residual)
- ½ rate N application following 2nd grazing
- Tight final grazing in Autumn

Clover seedlings at the first grazing

Performance

Lessons Learnt

- Greater consideration of sward density
- Remove/address dead material if required

Plan for 2023

- Oversow another 6 ha of the grazing platform
- Sow between late Apr – late May
- Prioritise timings of grazing's post sowing
- Reduce N application on existing clover swards From 1st May

Discussion

Questions & Answers

Next Webinar

Thursday 9th February at 8pm

Ronan Coll (CAFRE):

Use of innovative technology to aid efficient use of nutrients

Richard Kane (TDF Farmer):

Experience of using precision technologies

Ciaran Hamill (CAFRE):

Steps to take to improve nutrient use efficiency in your business