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Resilience 4 for Dairy

Why Red Clover?

- Increasing cost of fertiliser
- Growing pressure on farmers to reduce their carbon footprint
- Existing EIP Project on MSS for Beef & Sheep has been a great success
  - However, this was concentrated on the Beef & Sheep sector (mainly Co. Down)
- We need solutions for the dairy sector and for silage
  - Dairy sector is very reliant on silage
- Previous work on red clover at Hillsborough had been encouraging (average yields of 14.6tDM/ha over 4 years on slurry only)
- However, there was limited experience with growing and utilising the crop

ZeroNSile Project

A total of 12 farms from across the province are taking part in this project, 6 dairy farms and 6 beef and/or sheep farms. An additional 3 farms in Co. Down are taking part in a smaller Lucerne study.

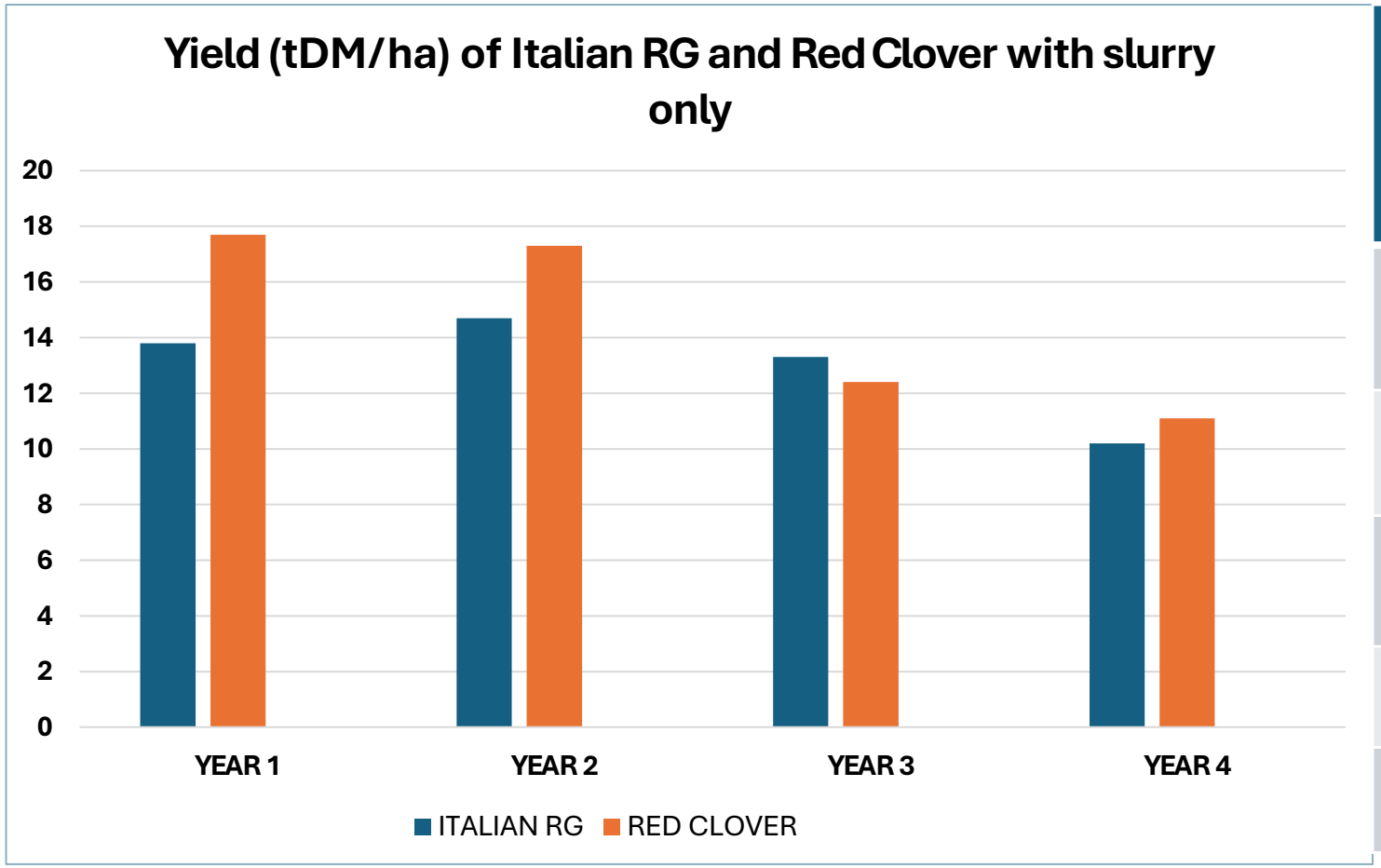
Project Aims –

- Determine the feasibility and practicality of growing a good quality silage with no chemical nitrogen from a long-term red clover and grass crop
- Establish the viability of growing a good quality silage crop with no chemical nitrogen from lucerne, a legume which has little on-farm research in NI

About the project –

- Up to 5ha of red clover is to be established on each farm, as well as a PRG control field of similar size and nutrient application.
- Silage yield and quality monitoring will take place on up to 3 cuts/year (may be less in the first year of establishment) and compared to conventional grass sards on the same farms.
- The farmers will also be keeping nutrient application records.
- Soil carbon measurements will be undertaken on the chosen fields in both the first and final year of the project.

Red clover yield potential



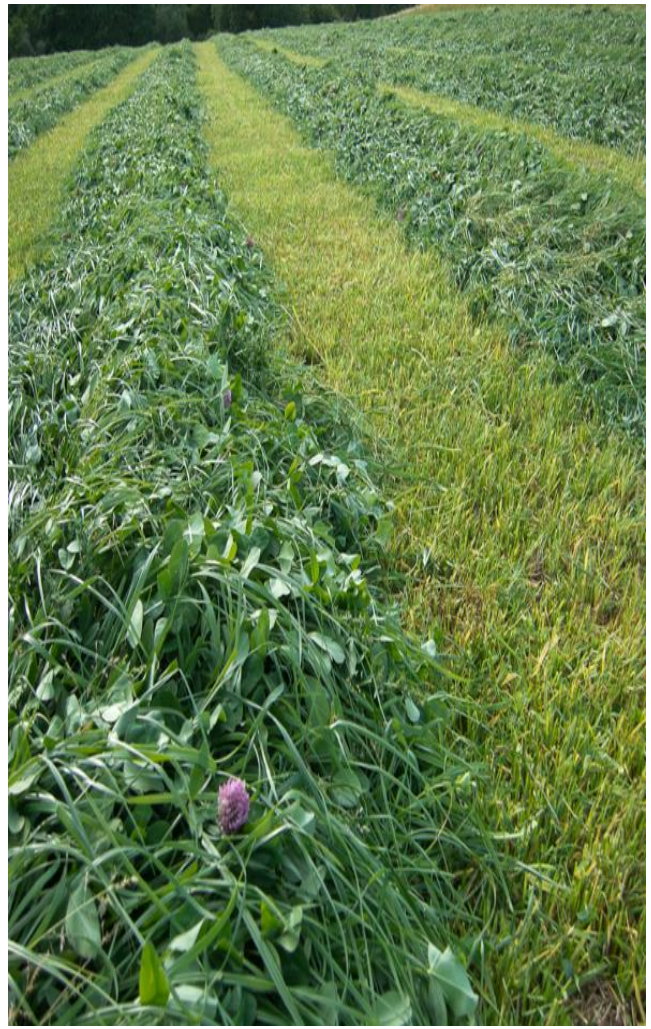
SWARD TYPE	4 YEAR YIELD AVERAGE (tDM/ha)	% Difference (Relative to PRG)
PERENNIAL RG	10.1	
HYBRID RG	11.8	+17%
ITALIAN RG	13.0	+29%
PRG/WHITE	12.6	+25%
RED CLOVER	14.6	+45%

Red Clover Silage Productivity

In silage mixtures over 6 years:

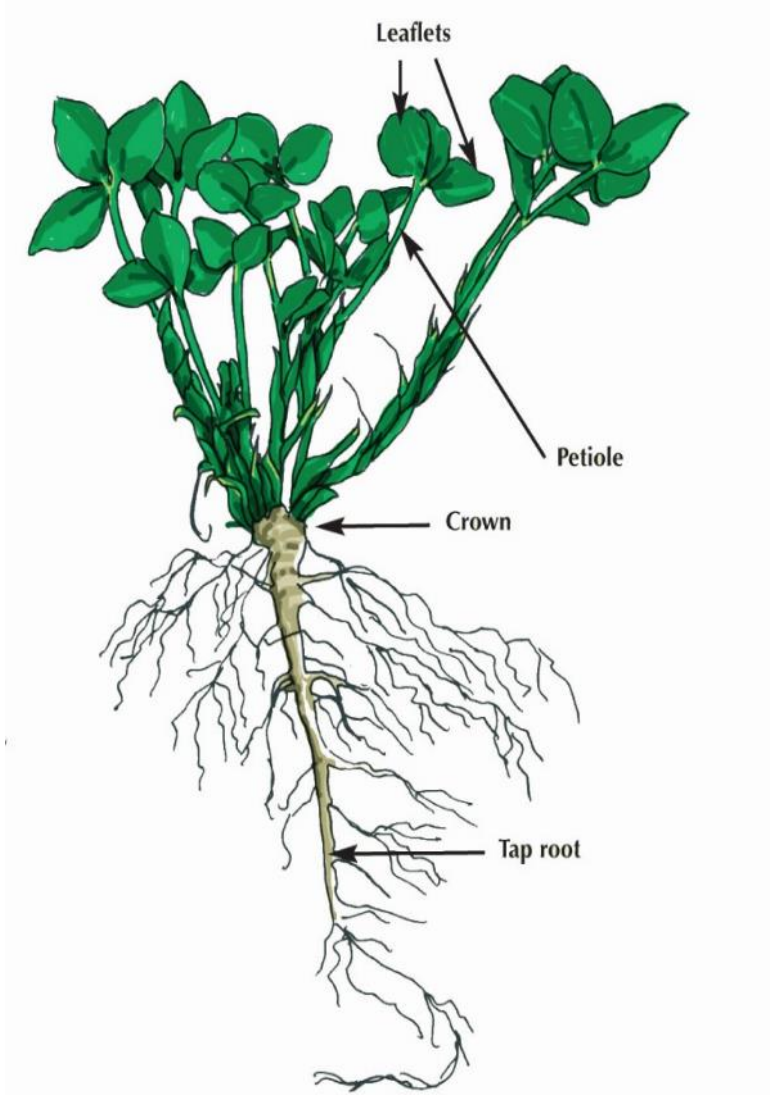
- Grass-red clover & zero N fertiliser produced similar annual DM yield to grass-only & 412 kg N/ha (15.8 vs. 15.7 tDM/ha)
- Early harvest (26th May) compared to late harvest (11th June) increased sward red clover content (62% vs. 46%)
- Red clover content and herbage production were greater when 0 kg N/ha was applied (61% and 15 tDM/ ha, respectively) compared to 50 kg N/ha applied (48% and 14.8 tDM/ha, respectively)

source:Teagasc



Establishment

- Sward kill, plough/disc/power harrow cultivation, stale seed bed – time dependent
- Overseeding: less suitable for stitching in than WC - distribution
- Fine, firm fertile seedbed (rolling)
- Do not sow too deep:– 5-10mm max
- 500 000 seeds per kg (x3 size of WC)
- Warm soil temperature required (8'C) late April/early May – late June
- Mixture: 9kg grass & 4kg red
- Monoculture: 6kg red
- Grass companions: hybrid & PRG; other grass species
- Soil pH to 6.5 – n.b. not just for the soil
- Seed bed fertilizer – P/K only required



Weed control

- Ideal: clean ground in previous years
- Post emergence spray: usually approx. 6 - 8 weeks post seeding
- Must be red clover safe – check label!
- Target: spray when majority of clover seedlings have trifoliate leaf present AND small dock leaf size (~£2 coin)
- Spray too early = kill too many clover seedlings
- Spray too late = canopy closes and protects the dock seedlings from the herbicide… problems with docks later
- Chickweed etc: one or two ‘fast’ grazings normally controls
- Alternative? spot spraying

After first winter…

Establishment

Biological nitrogen fixation (BNF): air- soil- plant-animal

the Clover 50 rule...

Scenario: 15tDM/ha grown/yr (zero fert N)
30% clover = 5tDM
X 50 = 250kgN as plant available N in soil

BUT...

pH = 5 no BNF even if clover present!
pH = 7 ideal for BNF

P & K requirements at establishment

Source: Nitrates Action Programme Regulations (Northern Ireland) 2019; RB209 (March 2022)

	Soil phosphorus index					
	0	1	2-	2+	3	4
	Phosphorus recommendation (kg P_2O_5 per ha)					
At establishment	120	80	65	50	30	0

	Soil Potash Index					
	0	1	2-	2+	3	4 & higher
	Potash recommendation (kg K_2O per ha)					
At Establishment	120	80	60	40	0	0

n.b. 2500 gals/ac = 28.1m3/ha supplies 33.6 kg available P_2O_5/ha and 64.4 kg available K_2O/ha

Varieties

Recommended List of Red Clover Varieties 2023/2024

		Mean of G varieties	Diploids							Tetraploids			
			Merviot	Lemmon	AberClaret	Harmonie	Sinope	Fearga	Ganymed	Amos	Maro	Atlantis	Magellan
Recommended List status			S	G	G	G	PG	G	PG	G	G	G	G
Conservation: management													
Total yield 1st harvest year (% of 12.06 t DM/ha)		100	104	99	101	98	101	99	103	100	99	102	100
Total yield 2nd harvest year (% of 12.95 t DM/ha)		100	97	98	102	99	100	101	104	100	96	100	101
Total yield 3rd harvest year (% of 10.04 t DM/ha)		100	83	96	105	98	99	106	108	95	88	101	104
Total yield: Mean (% of 11.70 t DM/ha)		100	95	98	103	98	100	101	105	98	95	101	102
Protein content %													
1st cut - 1st harvest year		17.8	17.1	17.6	17.0	18.3	17.8	17.1	16.6	18.1	18.0	17.8	18.0
2nd cut - 2nd harvest year		19.8	19.6	19.5	18.7	19.6	19.5	18.3	18.2	20.2	19.7	20.5	20.2
2nd cut - 3rd harvest year		20.0	19.2	19.7	19.0	20.3	19.1	18.6	19.2	20.5	19.8	20.2	20.2
Agronomic characters													
Ground cover % (1st harvest year)		71	70	71	69	73	69	66	72	72	65	70	72
Ground cover % (2nd harvest year)		62	50	60	59	66	61	58	63	61	50	61	62
Ground cover % (3rd harvest year)		50	33	51	49	56	46	48	52	46	37	49	50
Conservation seasonal growth													
1st harvest year	1st Cut (% of 5.53 t DM/ha)	100	105	99	96	101	102	91	104	100	98	103	101
	Protein yield: 1st Cut (% of 0.98 t DM/ha)	100	101	98	92	103	102	87	97	102	99	103	102
2nd harvest year	2nd Cut (% of 3.63 t DM/ha)	100	97	92	105	99	99	104	102	102	98	101	102
	Protein yield: 2nd Cut (% of 0.72 t DM/ha)	100	96	91	98	98	98	96	94	104	98	105	104
3rd harvest year	2nd Cut (% of 3.31 t DM/ha)	100	86	91	106	97	91	109	104	101	90	100	104
	Protein yield: 2nd Cut (% of 0.66 t DM/ha)	100	83	90	101	99	87	101	100	104	89	102	105
Year First Listed			1980	2003	2010	2012	2018	2018	2022	2005	2010	2011	2014
Breeder			ILVO	ILVO	IBERS, Aberystwyth	Nord. Pflan/ DSV	DLF Seeds A/S	Teagasc, Eire	DLF Seeds A/S	Slechtitelská stanice, The Czech Republic	LSPB	Nord. Pflan/ DSV	Nord. Pflan/ DSV
Agent			Limagrain UK Ltd	Barenbrug UK Ltd	Germinal	DSV	DLF Seeds Ltd	Goldcrop Ltd	Limagrain UK Ltd	DLF Seeds Ltd	Limagrain UK Ltd	DSV	DLF Seeds Ltd
Number of trials for yields													
1st harvest year			15	15	15	15	9	12	6	15	15	15	15
2nd harvest year			13	13	13	13	7	10	6	13	13	13	13
3rd harvest year			13	13	13	13	4	7	6	13	13	13	13

G General Use S Recommended for Specific Use PG Provisional General Use Recommendation PS Provisional Specific Use Recommendation

Project seed mixtures

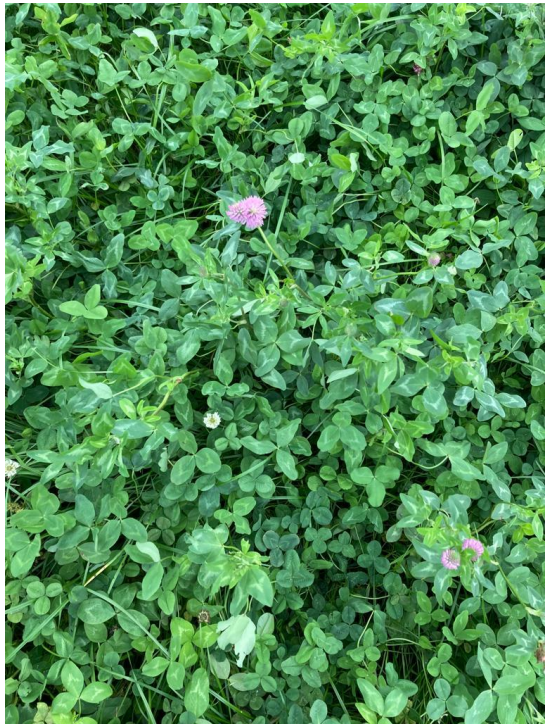
	1	2	3	Plus Timothy
Diploid PRG	5.0	4.9	6.0	5.5
Tet. PRG	3.0	2.8	4.5	4.0
Timothy	0.0	0.0	0.0	1.0
Total Grass	8.0	7.7	10.5	10.5
Red Clover	3.0	4.9	3.5	3.5
White Clover	1.0	1.4	1.0	1.0
Total	12.0	14.0	15.0	15.0

Red Clover:
Aberclaret Garant
Ostro Rozeta

White clover:
Alice
Barblanca

Red Clover: Sward Management

- BNF can supply all of a red clover sward's nitrogen requirements (200 – 300 kg N/ha/year)
- Principally a forage crop for silage production. Target 3 cuts of silage and 1 grazing.
- Physical 'damage' is a major limitation to a red clover swards longevity, including over-grazing, poaching and compaction by machinery.
- There is a risk of bloat with grazing red clover swards.
- A 5-year break is needed between red clover crops to help minimise damage from stem eelworm and clover rot
- Dock/weed control can be difficult, limited spray options available.
- High phyto-oestrogen content.



Red Clover: Silage Production

- Target first cut mid-May and subsequent cuts every 6 to 7 weeks thereafter
- Red clover silage is more difficult to ensile and requires a greater attention to detail.
- Target a dry matter of 25 – 30%, with a 48-hour wilt.
- An over-wilt will increase the risk of leaf shatter.
- Do not cut too low (minimum 10cm) to avoid damaging the crown of the plant.
- Will not coincide with the cutting times of grass only leys.
- More palatable than grass silage and provides a higher quality protein than other legumes.

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Red Clover: Nutrient Management

- Apply phosphate, potash and magnesium as recommended for pure grass swards.
- Low potash supply can restrict the growth of clover, even when there seems to be enough for grass.
- Phosphate is also critical for N fixation. Clover growth is often limited in low phosphate situations.

Phosphorus Requirements

Source: Nitrates Action Programme Regulations (Northern Ireland) 2019

	Soil phosphorus index					
	0	1	2-	2+	3	4
	Phosphorus recommendation (kg P_2O_5 per ha)					
At grass establishment	120	80	65	50	30	0
Silage cut[1]						
First	100	70	55	40	20	0
Second	25	25	25	25	0	0
Third	15	15	15	15	0	0
Fourth	10	10	10	10	0	0

[1] *The amount of phosphate applied for establishment shall be deducted from the first season's grazing, silage or hay crop requirement for phosphorus.*

 # Derogated Farmers have to keep within a P balance of <10kgP/ha/year (1kg P = 2.291 kg P_2O_5)

Potash Requirements

Source: RB209 (March 2022)

	Soil Potash Index					
	0	1	2-	2+	3	4 & higher
	Potash recommendation (kg K_2O per ha)					
Establishment	120	80	60	40	0	0
First Cut - Previous Autumn	60	30	0	0	0	0
First Cut - Spring	80	80	80	60	30	0
Second Cut	120	100	90	60	40	0
Third Cut	80	80	80	40	20	0
Fourth Cut	70	70	70	40	20	0

To minimise luxury uptake of potash, no more than 80–90 kg potash per ha should be applied in the spring for the first cut. The balance of the recommended rate should be applied in the previous autumn

Red Clover: Manure value

- Slurry and manures are an ideal method to supply P & K requirements .
- To accurately calculate application rates, analyse the nutrient content of the slurry.
- Typical nutrient values of slurry are shown:

Source: AHDB, Establishing and growing clover, 2021

Manure type	Dry matter (%)	Nitrogen (kg N/t)*	Phosphate			Potash		
			Total phosphate (kg P_2O_5/t)	Availability (%)	Available phosphate (kg P_2O_5/t)	Total potash (kg K_2O/t)	Availability (%)	Available potash (kg K_2O/t)
Cattle farmyard manure*	25	6.0	3.2	60	1.9	9.4	90	8.5
Cattle slurry*	6	2.6	1.2	50	0.6	2.5	90	2.3
Sheep farmyard manure*	25	7.0	3.2	60	19.0	8.0	90	7.2

*Values vary depending on the dry matter %, age of the manure/slurry, soil type and season in which it is spread

Benefits of Red Clover

- High Yields – up to 15 t/ha (5.5t/acre)
- Protein content of 15 – 20%
- Protein degradation is a lot less than other legumes – leading to a higher quality protein
- Builds fertility for following crops (typically providing 40-50 kgN/ha)
- Helps improve soil structure
- Reduces the amount of bought in fertilisers
- More palatable than grass silage
- High level of drought tolerance
- Can be grown on a wide range of soil types
- Can be used as part of a crop rotation/ reseeding policy

Possible Drawbacks of Red Clover

- Red clover can be variable in its establishment
- Pre establishment weed control essential
- Only lasts 3 -4 years
- 5 year break needed between red clover crops
- Not suitable for intensive grazing
- May not fit in with the cutting times of normal grass leys
- Must remember to leave a higher cutting height
- More difficult to ensile than normal grass leys - wilt