Soil Improvement Programme

Dowth Research
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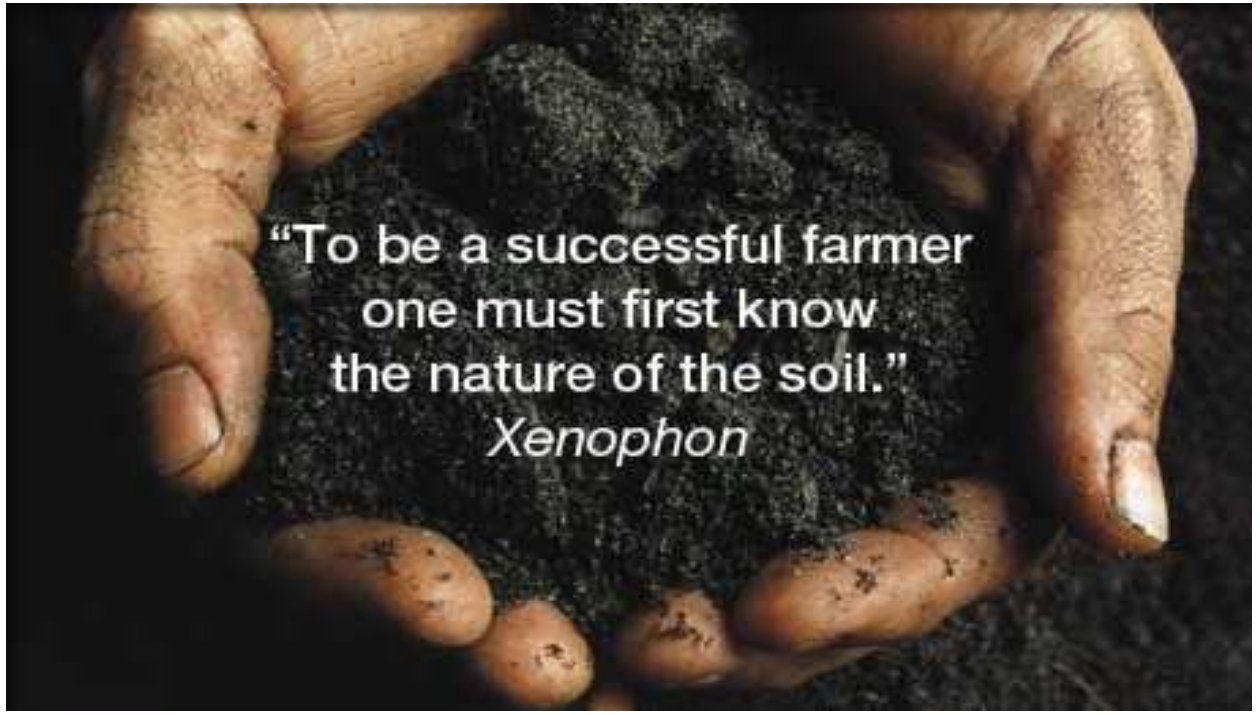
Healthy Soils Healthy Grass Healthy Cows

Importance of Soil



Greek philosopher 430-354 BC

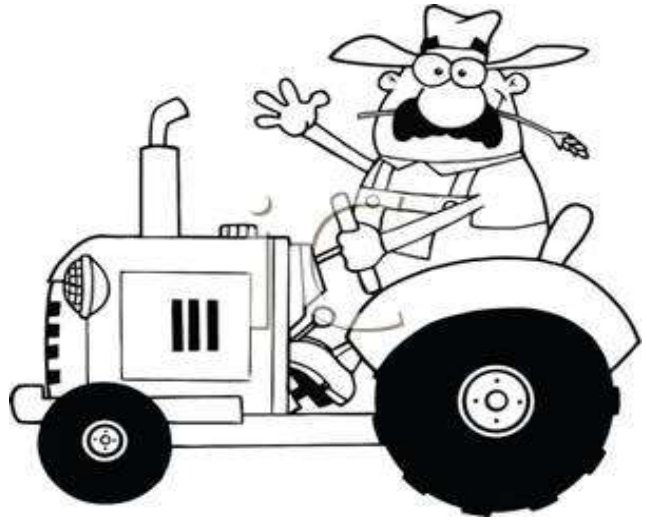
Issues in Soil Health

- 70% of soils in GB are severely or moderately compacted (AHDB, 2013)
- 90% of Irish soils have sub optimal fertility (Teagasc, 2015)
- Soil microbiology is in decline
- Soil erosion is causing issues with water quality globally

Issues with Forage Quality

Over the last 20 years-

- Iron levels have increased by 200% = Reduced immunity
- Potassium levels have increased by 50% = Reduced calcium mobilisation
- Molybdenum levels have increased by 30% = Fertility and immunity issues



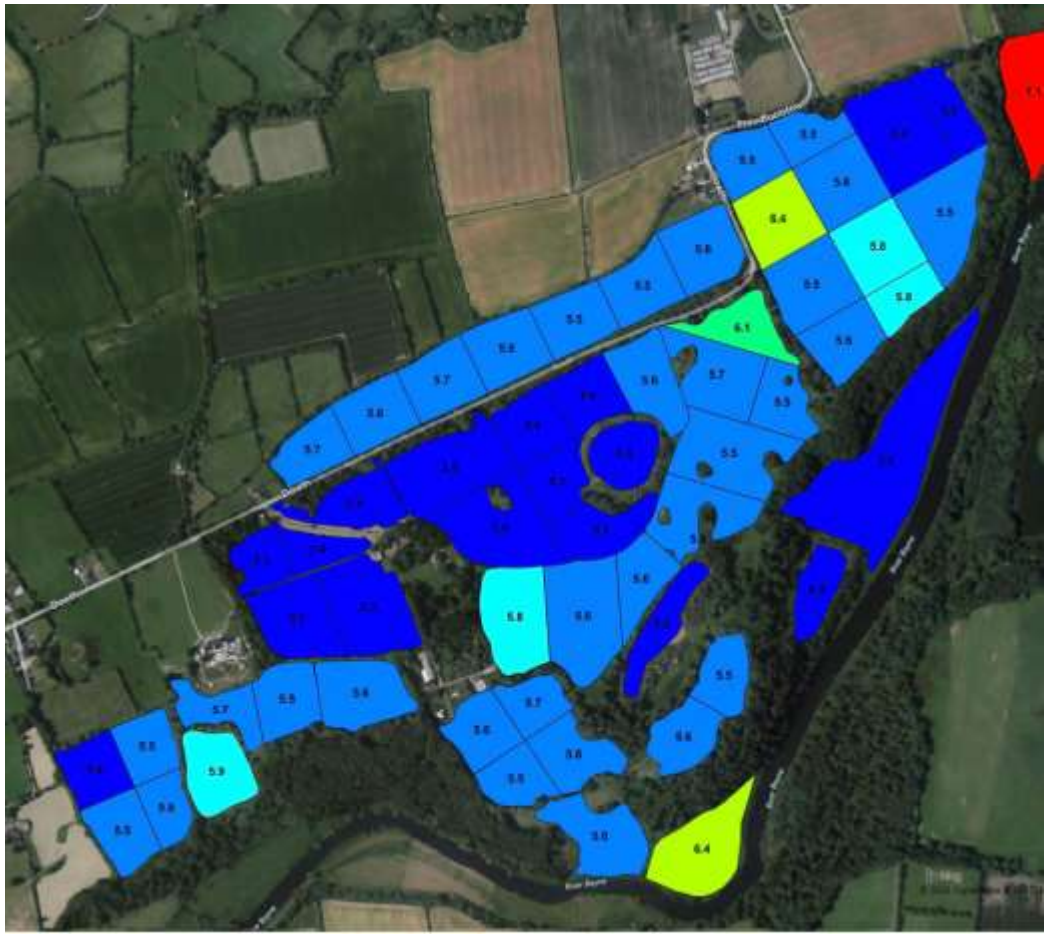
Have we lost touch with our soils?

Dowth 2014

Average soil fertility in 2014

- pH- 5.5
- P Index- 1+
- K Index- 1+

- Sward was in poor condition with little PRG or Clover in the sward



3 Step Soil Improvement Programme

1. Physical -Aeration
2. Chemical -Nutrient and Mineral Balance
3. Biological -Compost Slurry

DEVENISH™
Beyond Nutrition

THOMSON & JOSEPH

Physical

“Soil compaction is the greatest threat to grassland production and can reduce yields by up to 40%.” *Dr. Paul Newell, ADAS Senior Soil Scientist (Grassland & Muck, 2014)*

Benefits of Aeration

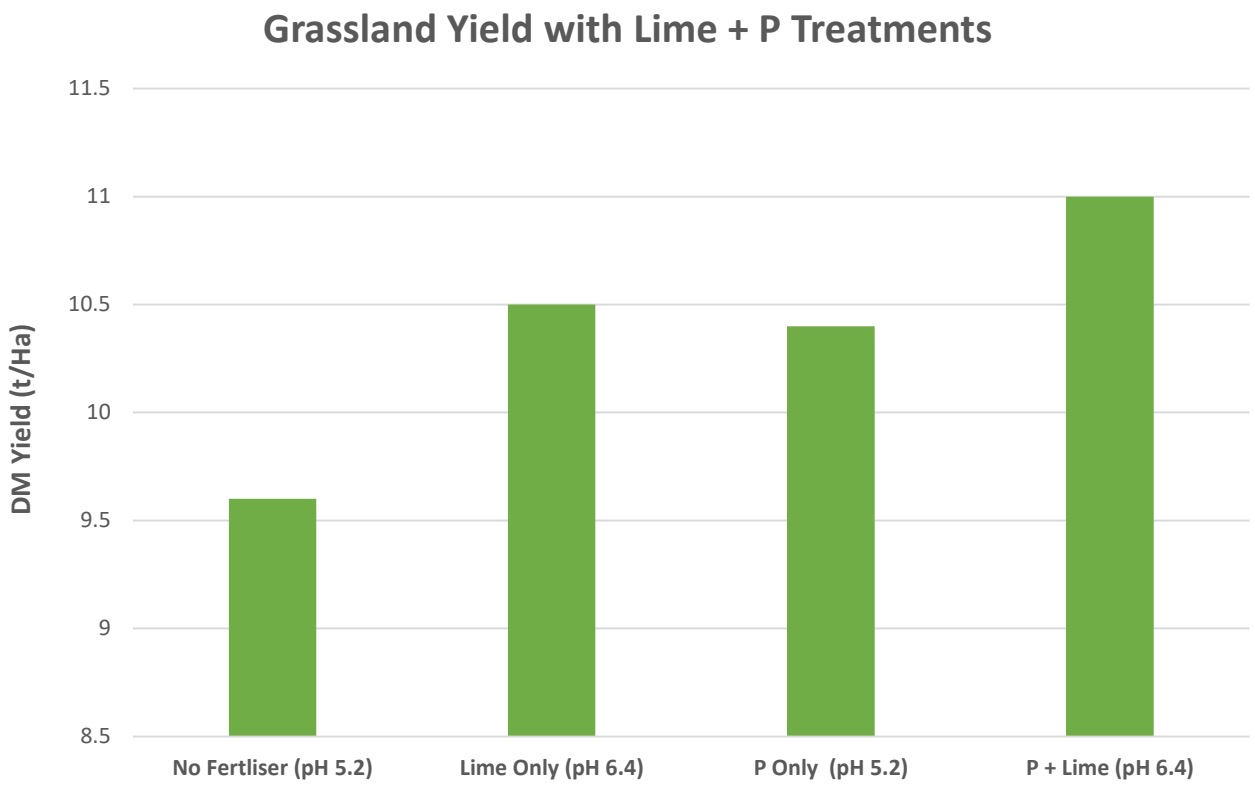
- Disrupt surface compaction
- Allow air penetration
- Improve drainage
- Encourage root development
- Stimulate soil life
- Increase grazing days by 5 days (AHDB 2015)

Year	Untreated Control		Aerated	
	Grass Growth (kg/DM)	N Uptake (kg/ha)	Grass Growth (kg/DM)	N Uptake (kg/ha)
1985	14	1.2	60	3.1
1986	36	1.5	53	2.1
Average	**25**	**1.35**	**56.5**	**2.6**

Effects of aeration on grass growth (kg/ha/day DM) and nitrogen uptakes (kg/ha/d) on a heavily compacted soil in Wales. Davies et al. (1989).

Chemical

- N, P and K all have a reduced availability at a pH below 6
- ROI of liming 4:1 (Teagasc, 2016)
- Ca:Mg balance is key to soil structure



Grass DM yield response in grassland treated with Lime (5 t/ha of lime), P fertiliser (40 kg/ha of P), and P + Lime over a full growing season (No Fert. = No P, No Lime) Teagasc, 2016

Effect of Soil pH on Fertiliser Utilisation

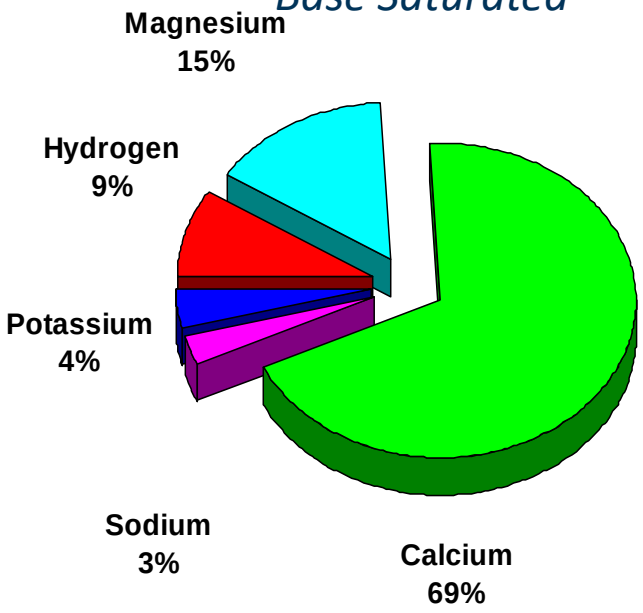
Soil pH	Nitrogen Utilisation	Phosphorus Utilisation	Potassium Utilisation	% of Fertiliser Wasted
5.0-5.5	77%	48%	77%	32%
5.5-6.0	85%	52%	100%	21%
6.0-6.5	100%	100%	100%	0%

Teagasc 2017

Cation Exchange Capacity

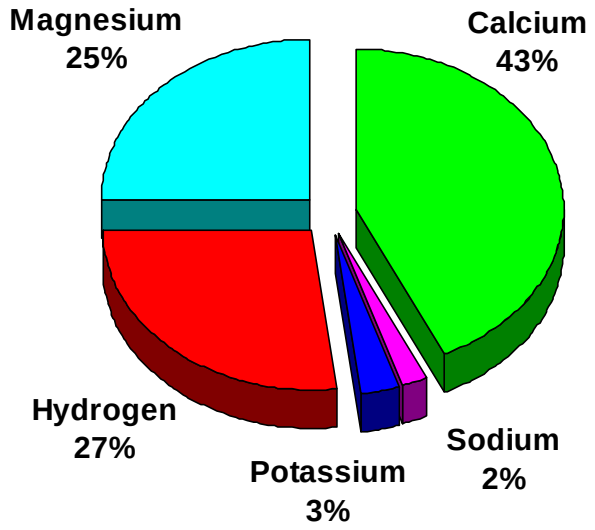
Well Balanced Soil

"Base Saturated"



Poorly Balanced Soil

"Low In Base Saturation"



Biological

- A single teaspoon of rich soil can hold up to one billion bacteria, several yards of fungal filaments, several thousand protozoa, and scores of nematodes (Kathy Merrifield, Oregon State University)
- Soil biology is key for soil structure, carbon/nitrogen cycling, water filtration and preventing disease in plants.

“Without the work of this humble creature,
who knows nothing of the benefits he confers upon mankind,
agriculture, as we know it,
would be very difficult, if not wholly impossible”
Charles Darwin

Digest-it ®

Digest-it is a liquid biological composting product:

- It contains aerobic bacteria, enzymes and nutrients
- Its purpose is to aerobically digest (compost) slurry to-

✓ Improve fertiliser nutrient levels

✓ Reduce ammonia concentration and odour

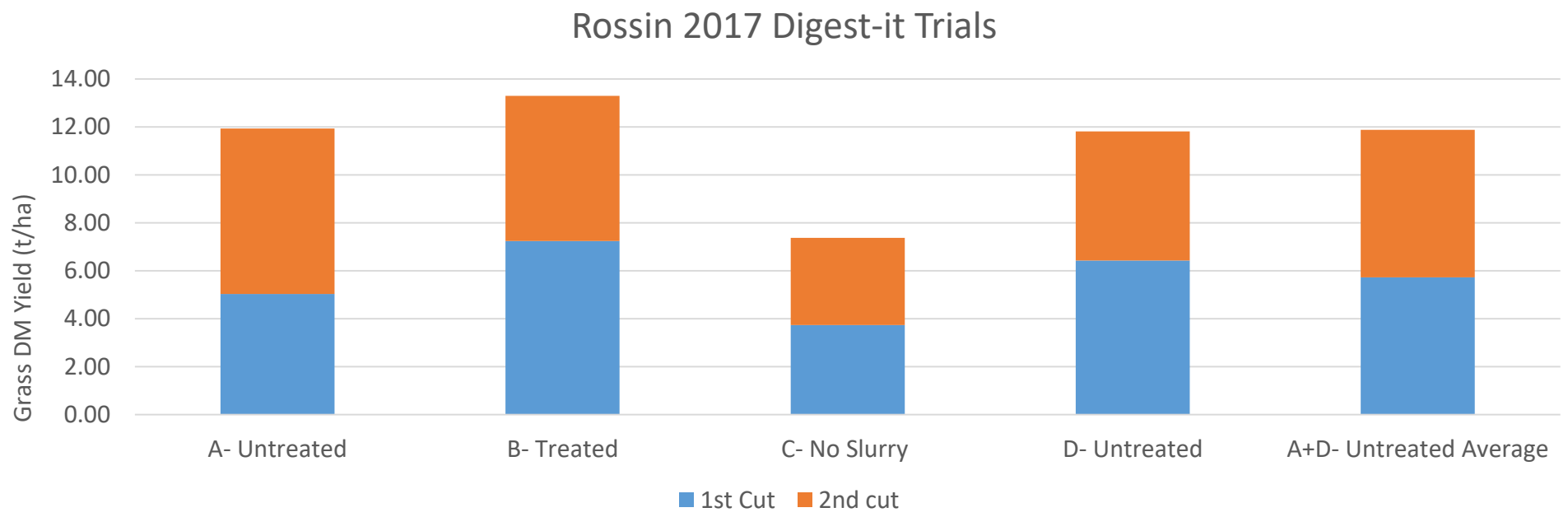
✓ Breakdown crusts and solids

✓ Improve soil fertility

Digest-it ® Trials at Lands of Dowth

- 4 treatments of dairy slurry on improved and unimproved pasture
- Application of equivalent 2000g/acre of slurry on a 24x7m plot
- Destructive harvest using a zero grazer
- Grass is weighed fresh and two samples taken for DM analysis
- Average of two samples used to calculate DM yield

Digest-it ® Trials – Improved Sward



Digest-it ® Trials – Improved Sward

Field	Plot	1st Cut (T DM/Ha)	2nd Cut (T DM/Ha)	Total (T DM/Ha)
Rossin	A- Untreated	5.03	6.91	11.93
Rossin	B- Treated	7.24	6.06	13.29
Rossin	C- No Slurry	3.73	3.64	7.37
Rossin	D- Untreated	6.42	5.38	11.80
Rossin	A+D- Untreated Average	5.72	6.14	11.87

- Extra **1.42t** DM/Ha grown on treated vs. average untreated.
- **12%** more grass grown
- Estimated an extra **1.21t** utilised grass
- Extra **€189.27 /ha** margin on dairy farms (Teagasc 2017)
- **6.38:1** ROI (Teagasc)

Dowth 2018

Average soil fertility in 2018

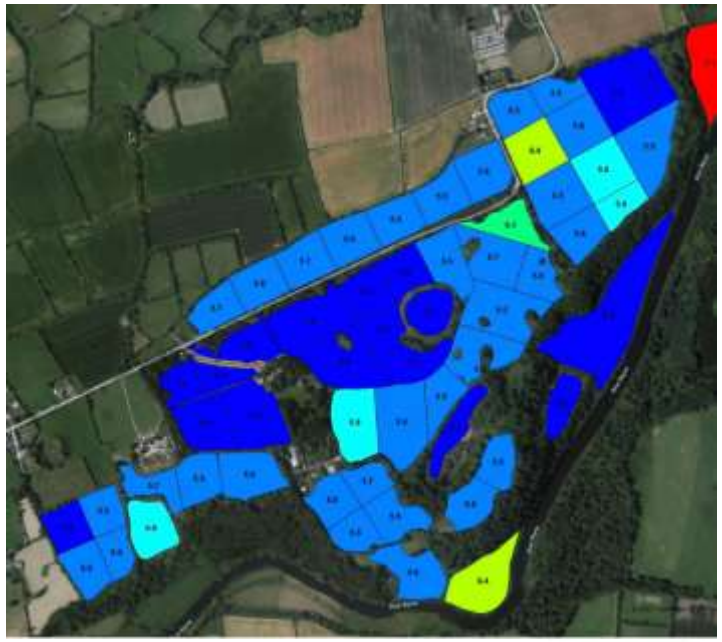
- pH- 6.1
- P Index- 1+
- K Index- 1+

- Sward has a good cover of PRG and White clover without reseeding.

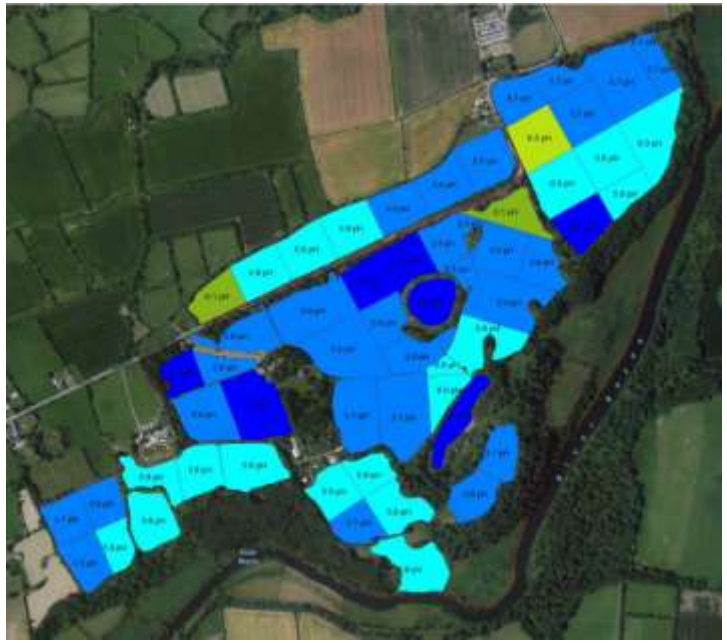
Progress to date

Above 7.0 pH
6.7 - 7.0 pH
6.4 - 6.6 pH
6.1 - 6.3 pH
5.8 - 6.0 pH
5.5 - 5.7 pH
5.0 - 5.4 pH
Below 5.0 pH

2014- 5.5



2016- 5.7



2018- 6.1

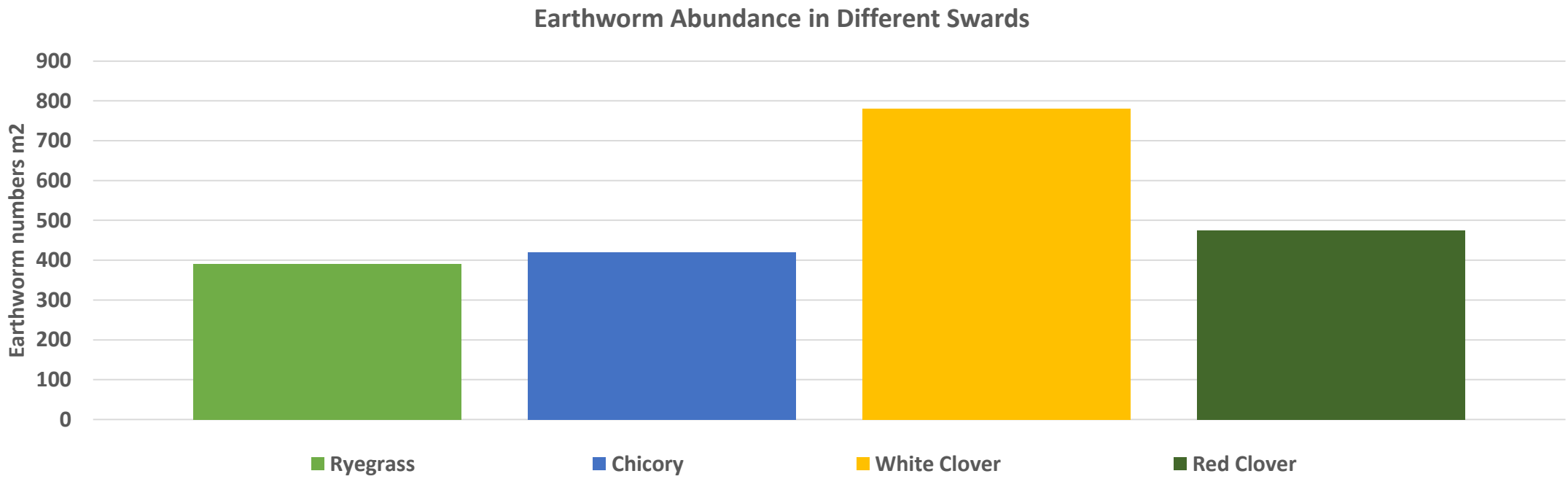
Improving Grassland Utilisation

- It is vital to use the extra grass grown effectively
- PRG can only support three living leave it is important that grass is grazed at the 2.5 leaf stage to maximise efficiency
- Measuring grass regularly helps to build a farm feeding wedge and aid grass management by baling in times of surplus and supplementing in times of deficits
- Pen guide in at 10cm (length of pen) out at 4cm (length of pen lid)
- Research found every hour spent on grassland management is worth £85 be it measuring grass, moving fencing or shifting troughs (AHDB, 2016)

Improving Grassland Utilisation

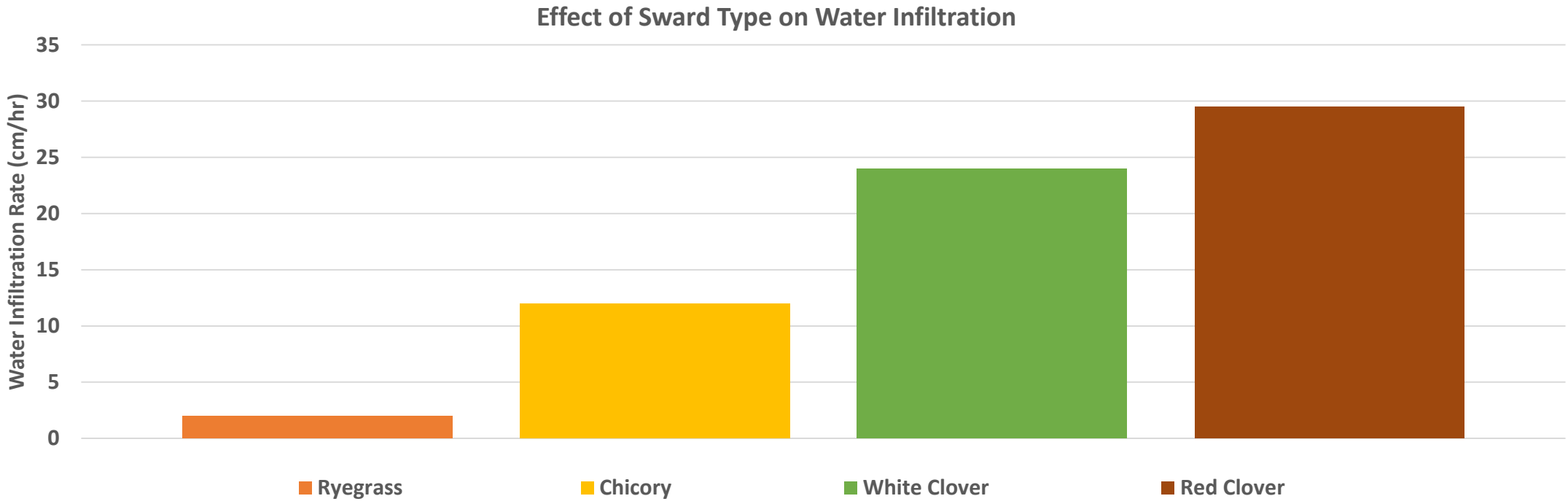
- Grazing infrastructure is key to improving grass utilisation
- Using a rotational paddock grazing system over set stocking increases utilisation by up to 92% (AHDB, 2016)
- Improving grassland species has been seen to increase DLWG in lambs by over 20g per day (SRUC, 2015)
- Grass clover swards without fertiliser have the ability to grow 7.5t DM/Ha and increase intakes.

Effect of Sward Type on Soil Biology



PROSOILS, 2015

Effect of Sward Type on Water Infiltration



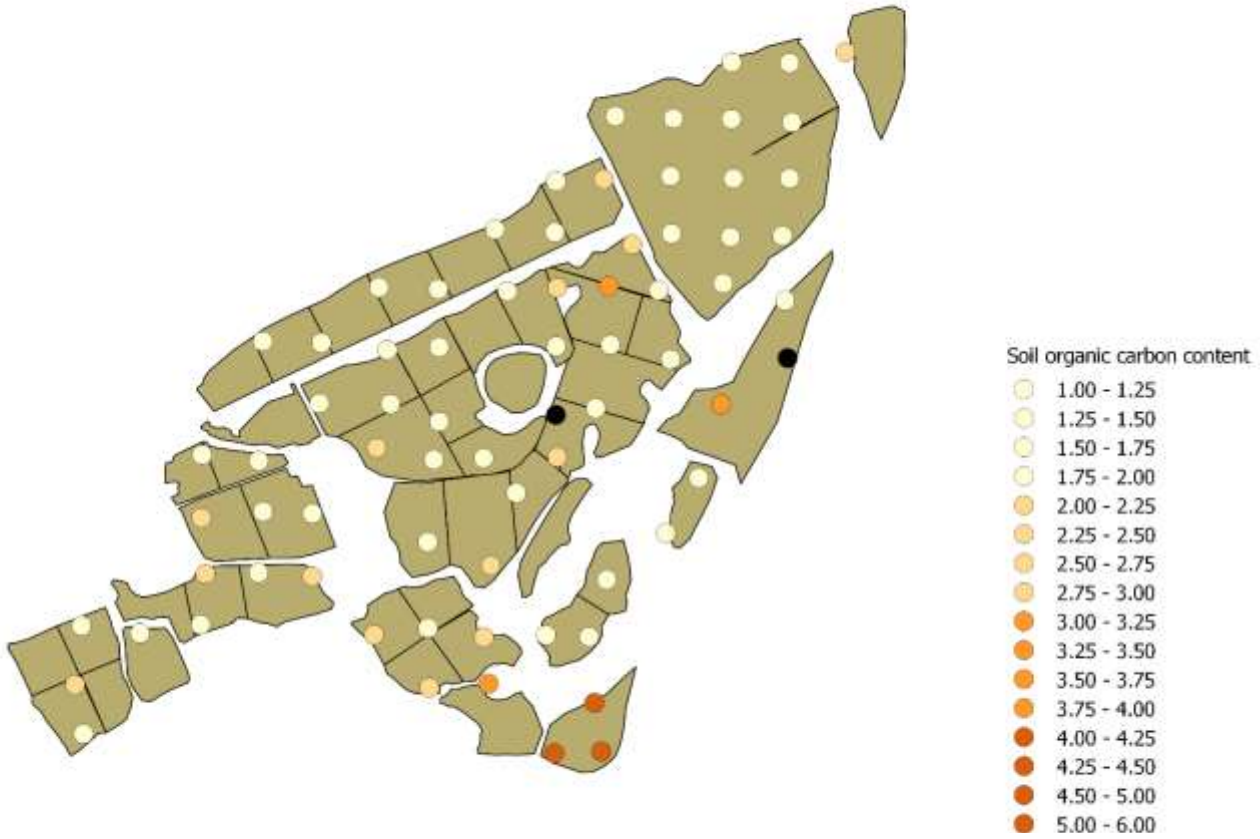
PROSOILS, 2015

Improving Grass Quality and Utilisation at Dowth

- Target to improve ME by 5.8%
- Optimise sward nutrition
- Improving grazing strategy and infrastructure
- Reseed trial area with Multi-species sward and PRG sward

Soil Carbon

- Average- 1.81% C
- Average- 56.4t C/ha
- Potential to sequester more carbon across Dowth



Future Plans

Research proposals-

- Heartland- Soil to Animal Optimisation
- Smartgrass- Animal performance on different sward types

On farm trials-

- Soil data probes
- In field grass quality measuring

Conclusion

- We have shown a marked increase in Soil fertility.
- The SIP has increased forage quantity and quality.
- Continue to measure performance at Dowth to show improvement
- Focus on building Soil P, K and Carbon
- Develop Dowth as a research platform and demonstrate novel technology to farmers.

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