Future Proofing Beef Farming

"Grazing for Growth"

Farm Walk

John Egerton
Rosslea, Co. Fermanagh

Wednesday 24th April 2019

AgriSearch, AFBI & CAFRE would to like to thank
the Egerton family for hosting this event

GrassCheck is supported by:

"Beef from Grass"

- Investigation into the effects of different grazing strategies and sward types on:
  - Grass growth and quality
  - Animal performance
- On-farm work to:
  - Understand grass growth **potential** across Northern Ireland
  - Identify variability in grass production and quality
  - Monitor livestock **performance** across a range conditions

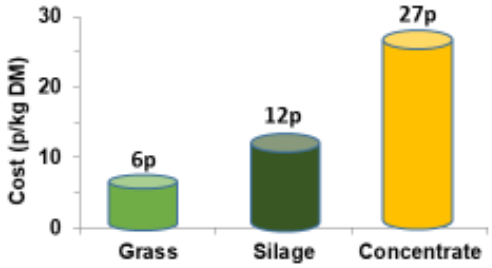


Fig 1: Cost of Individual feedstuffs

Fig. 2: GrassCheck farm network

2018 grazing season – Plots and beef farms

Plots:

- 10.8t DM/ha grown
- Summer yield ⬇1.2t DM/ha due to drought
- Strong recovery in September

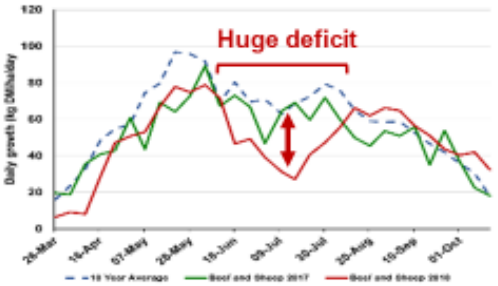


Fig 4: Grass growth curve – Beef and Sheep farms

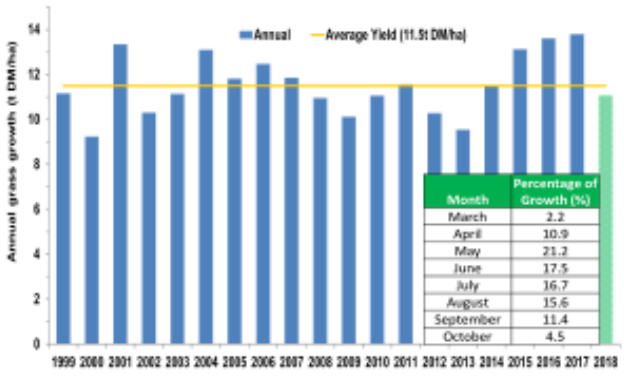


Fig 3: GrassCheck plots - herbage production

Table 1: Grass – Beef and Sheep farms

	Dry matter (%)	WSC (%)	Crude Protein (%)	ME (MJ/kg DM)
Beef and Sheep farms 2017	16.6	11.4	19.5	12.2
Beef and Sheep farms 2018	18.6	11.2	18.4	12.5
10 year average (Plots)	18.1	11.3	20	13.9

Herbage production on farm - 2018

Herbage production:

- Total grown = 13.3 t DM/Ha
- Total utilised = 11.7 t DM/Ha (88%)
- Paddock yields range: 8.6 – 13.7 t DM/Ha

Managing grass on Egerton's farm:

- Operate a paddock grazing system
- Avg. paddock size = 0.48 Ha
- 3 day rotation and 21 day growing period

Grass covers:

- Pre-grazing: 2700-3000 kg DM/Ha
- Post-grazing: 1500-1700 kg DM/Ha

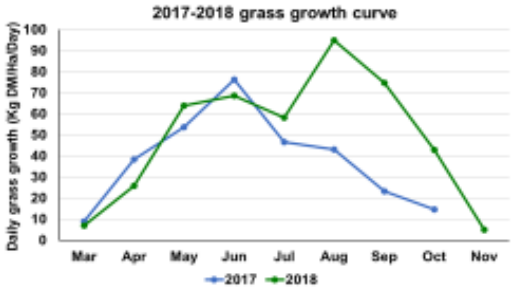


Fig 5: Grass growth curve – Egerton farm

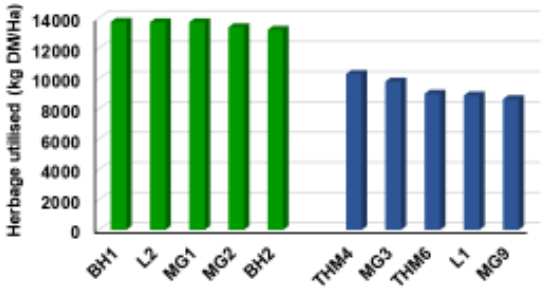


Fig 6: Highest and lowest yielding paddocks – Egerton farm

Farm background

Land area - 2019

- 72 Ha grassland

- **Livestock - Currently on-farm**
- 90 Suckler Cows
- 15 In-calf heifers
- 90 growing cattle
- 120 ewes + 30 ewe lambs

Production systems on-farm

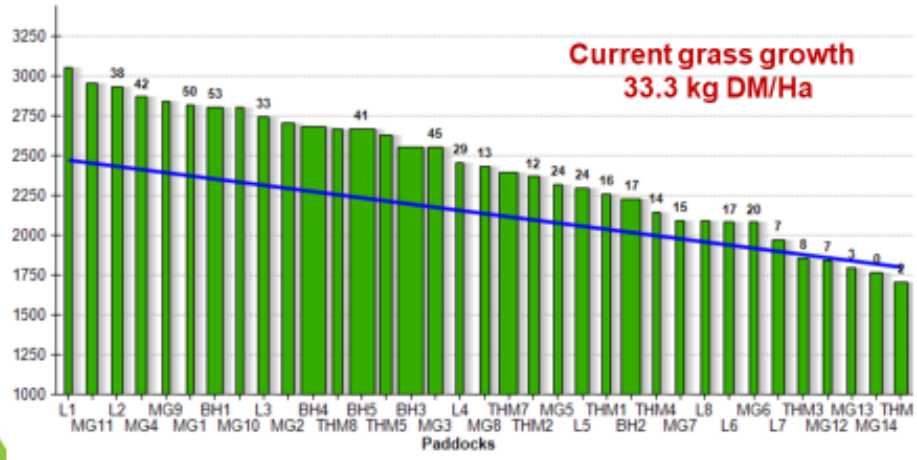
- 50:50 Spring/Autumn calving - using AI for past 19 yrs
- Male calves – finished bull beef
- Female calves – reared as replacement heifers and surplus sold
- 30 dairy heifers (contract reared) and new calf blade scheme

2019 grazing season to date

Current grass farm cover = 2429 kg DM/Ha

Cattle turned out to date:

- Cows: 10 at 500 kg
- Cattle 0-1 year: 29 animals at 250 kg (since early Feb)
- Cattle 1-2 year: 37 animals at 400 kg (since early April)



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Soil Nutrient Management: Potash & Sulphur

Potash (K):

- Required for optimum yields and efficient use of N
- Deficiency can reduce yields by up to 30%

2017/18 soil samples found on beef farms:

- 26% of fields were undersupplied with K
- 25% of fields had high soil K (> Index 2+)

- Applying too much potash to grazing fields in spring can be a contributing factor in grass tetany

Sulphur (S)

- Deficiency is widespread across NI and can reduce yields by 30%

- S-containing fertiliser should be applied routinely to all grazing and silage fields, particularly for 1st cut

Test your soil and monitor nutrient inputs
Nutrient surpluses can be as harmful as deficits

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Soil Nutrient Management: Lime and Slurry

Lime

43% of NI grassland requires lime and could be losing 2 t DM/ha/yr

Correcting soil pH is potentially worth a 5-fold return on the lime investment

Maintaining soil pH close to pH 6.0 is essential for nutrient uptake and optimal grass growth

Slurry

Slurry is an excellent source of nitrogen (N), phosphorous (P) and potassium (K)

Make the most of slurry nutrients by spreading in spring

Use low trajectory spreading techniques such as trailing shoe

Trailing shoe reduces N loss and can improve yields by up to 25%

Soil Nutrient Management: Phosphorus

Surplus P is harmful to the environment

2017/18 soil samples indicated:

- > 40% of fields over-supplied with P
- 15% of fields samples were under-supplied with P

	Soil P Index					
	0	1	2-	2+	3	4
Grass establishment	80	65	50	30	0	0
Grazed grass (whole season)	50	35	20	0	0	0
First cut silage †	70	55	40	0	0	0
Hay †	55	43	30	0	0	0

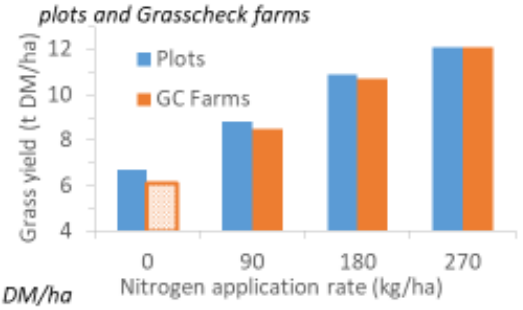
New Soil Phosphorus Recommendations

- Extensively managed grasslands receiving less than:60 kg chemical N/ha/yr; and < 120 kg manure N loading per annum (supporting grazing and one cut of silage or hay per season) have lower soil P requirements
- **The target soil P Index should be 2- (16-20 mg P/l)**

Grazing swards – fertiliser management

- Plot and farm data show cost effective response to N throughout season at high fertiliser application rates
- 1kg N fertiliser @ £0.8/kg delivers:
  21kg DM grass @ £0.136/kg = £2.86
  Return on Investment = **3.6:1**

Grass response to varying N application rates on plots and Grasscheck farms



RB209 Nitrogen fertiliser applications for swards growing 9-12 t DM/ha

	Mar	Apr	May	June	Jul	Aug	Total
kg/ha	30	30	30	30	30	30	180
Units/ac	24	24	24	24	24	24	144

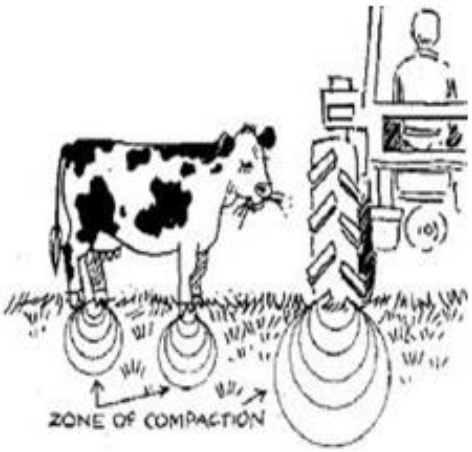
**If early spring grazing*

Phosphate
- Index 2- soil = 20 kg/ha (16 units/ac)
- Spring application

Potash
- 40% swards deficient
- Index 1= 30kg/ha (24un/ac)
- Autumn application

Sulphur
- Widespread deficiency
- 75 kg/ha (60 units/ac)
- Spring/summer application

Soil Compaction



- Soil compaction can reduce grass yields by up to 25%

Indicators of Compaction:
- Areas of surface water (ponding)
- Patchy crop growth – associated with heavy trafficking
- Soil with a 'cloddy' appearance and often containing blue mottles (through lack of oxygen)

Preventing or Reducing Compaction
- Keep off fields when wet
- Large tyre diameter and width in combination with lower inflation pressure
- Reduce total axle loads (ideally below 5 t)
- Control traffic movement within fields to avoid repeated overlap of tracks

Preventing compaction by careful management is more cost effective than expensive remediation strategies such as subsoiling or reseeding, which may be required in cases of severe compaction

The value of growing and utilising more grass

TOTAL GRASS GROWN (t DM / ha)	14	12	10	8	6
Grass utilised (t DM / ha) (85%)	11.9	10.2	8.5	6.8	5.1
Grass utilised per day (kg DM) 200d	60	51	43	34	26
Weight carried (kilos) (2% DM intake)	2975	2550	2125	1700	1275
Animals (440 kilos) / hectare	7	6	5	4	3
Animals (440 kilos) per 3.2 ha / 8 acres	22	19	15	12	9
WEIGHT GAIN (8 acre block)	TOTAL WEIGHT GAIN				
1.00	4327	3709	3091	2473	1855
£ per kilo liveweight	Value per field				
2.00	£8,655	£7,418	£6,182	£4,945	£3,709

8 acre block - Every extra t DM grown per ha = + £618 beef output
- Utilising 5.1t DM/ha vs 11.9 t DM/ha = + £4,946

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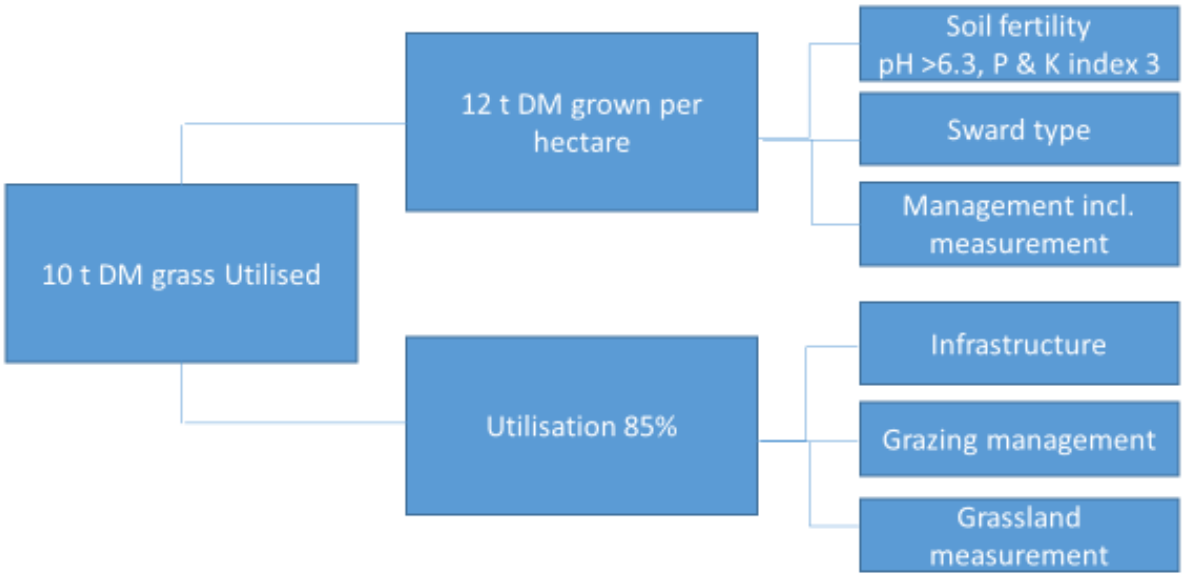
Growing and utilising more grass



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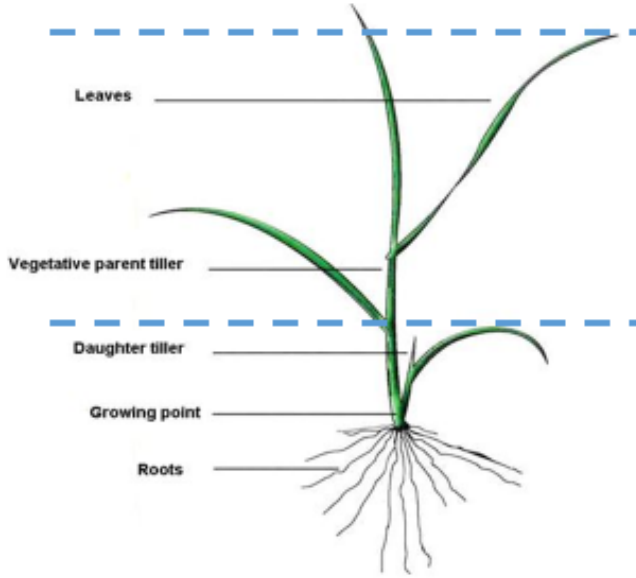
Keeping a supply of high quality leafy grass



8-10 cm
2800 – 3000 kg DM / ha

4-5 cm
1400 – 1600 kg DM / ha

- 3 leaves, 3 days, 3 weeks
- Sward heights, covers
- In at 10cm, out at 4cm
- 3000 kg DM/ha, 1600 kg DM/ha

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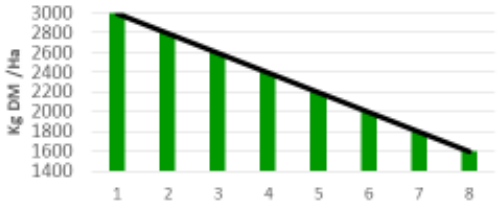
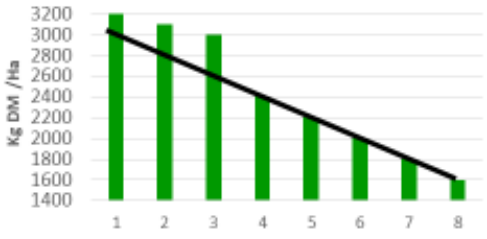
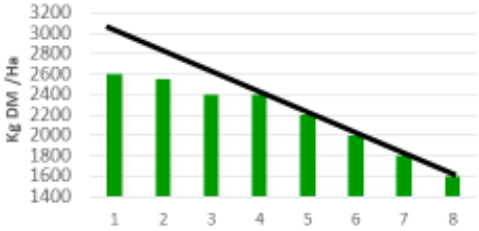


On Target
The perfect wedge, is where all paddocks meet the line. There are no surpluses or deficits



Surplus
- Remove surplus as quickly as possible, grass will be available sooner if growth slows
- Don't delay reaction to high grass growth
- If not 'too strong' get other animals to graze it or remove for silage



Deficit
- Before supply equals demand
- If possible increase daily grazing area if growth is not increasing
- Supplement with concentrate or high quality bales
- Re-graze area closed for silage if not too heavy

Grazing for Growth — Future Proofing Beef Farming

How does the quality of grazed grass vary over the season?

Table 1: 2018 Grass Check grass quality

	March	April	May	June	July	August	Sept	Oct
Dry matter (%)	24.0	18.6	16.2	19.0	22.9	14.3	15.6	15.6
Crude protein (%)	20.2	21.0	16.5	18.6	18.4	20.0	20.2	20.4
ADF (%)	24.0	23.5	26.3	31.7	30.1	30.9	29.4	30.1
WSC (%)	17.0	15.6	16.3	11.1	12.4	8.3	10.4	9.7
ME (MJ/kg DM)	12.2	12.3	11.8	10.8	11.1	10.9	11.2	11.1

Key message

- Grass quality varies during the grazing season
- Lush green grass is a highly nutritious feedstuff which can support high levels of performance throughout the grazing season
- Grass management is critical to ensure quality is maintained

Extending the grazing season - is it worth the hassle?

Turning cattle out to high quality, early spring grass offers the opportunity to:

- increase performance
- reduce feed costs
- reduce slurry production
- increase margins

Table 1: Effect of turning finishing cattle out to pasture early

	Early	Late	Difference
Turnout date	14 March	2 May	+ 49 days
Slaughter date	4 August	4 August	
Carcass weight (kg)	370	347	+23 kg
Carcass value (£)	1221	1145	+£76

Table 2: Effect of turning store cattle out to pasture early

	Early	Late	Difference
Turnout date	5 April	22 April	+ 17 days
Housing weight (kg)	538	515	+23 kg
Slaughter weight(kg)	674	666	+ 8 kg
Carcass weight (kg)	373	368	+ 5 kg
Carcass value (£)	1231	1214	+ £17

Extending the grazing season - is it worth the hassle?

Extending the grazing season into the autumn:

- reduces feed costs
- reduces silage requirements
- improves sward quality for next grazing

provided good grass supply and that the both weather and soil conditions are suitable

Table 3: Effect of extending the grazing into the autumn on suckler weanling performance

	Grazed#	Housed#	Difference
Housing date	29 Oct	23 Jan	+ 86 days
29 Oct weight (kg) (weaning)	228	228	
23 Jan weight(kg)	294	300	-6 kg
28 Feb weight (kg) (turnout)	339	339	
Daily feed cost (£/day)	1.14	1.76	- £0.62

#All weanlings received 2 kg concentrate supplementation & housed weanlings received average quality grass silage

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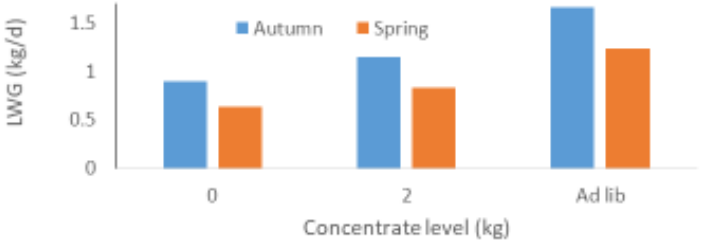
How much concentrate do you feed Holstein bull calves at grass?

- Autumn and spring born bulls
- Rotationally grazed
- 3 concentrate levels at pasture
- Intensively finished <16 months

Figure 1: Effect of concentrate level on grazing performance



Autumn born	0	2	Ad lib
Carcass weight (kg)	299	292	320
Carcass value (£)	867	847	928
Total conc. fed (t)	1.58	1.62	2.25
Carcass value - feed cost (£/head)	309	289	202

Spring born	0	2	Ad lib
Carcass weight (kg)	262	289	308
Carcass value (£)	760	838	893
Total conc. fed (t)	1.41	1.67	2.06
Carcass value - feed cost (£/head)	271	299	277

- Autumn born calves can be grazed without conc. supplementation
- Spring born calves required 2 kg/d conc. supplementation during the grazing period

Grazing for Growth Future Proofing Beef Farming

Maximising Beef from Grazed Grass

Francis Lively, Denise Lowe, Naomi Rutherford and Lauren Chesney
AFBI Agriculture Branch




Grazed grass is the cheapest source of feed available for beef cattle in Northern Ireland. Good grassland management is essential to maximise beef output. The main objectives of grassland management are to produce high yields of grass and to manage the grass and the cattle to ensure a high intake and a high level of animal performance. At the same time, under-utilization of the sward and wastage of grass needs to be avoided. These objectives are best achieved by turning cattle out as early as is practicable in the spring and maintaining the correct sward covers throughout the grazing season, so that cattle feed requirements are closely matched to the rate of grass growth.

Fertiliser and fuel costs have increased in recent years so the cost of producing grass has also increased. However, relative to other feed stuffs, grazed grass still remains the cheapest source of feed for beef cattle. With current high concentrate prices beef production systems relying on high concentrate input are not economically viable. On this basis it is critical to fully utilize all grass available for grazing.

GrassCheck

GrassCheck was originally established in 1999 to provide information on typical grass growth rates throughout the growing season. This data can be used in conjunction with individual farm data to benchmark grassland performance. Ongoing collection of this information each year is crucial in understanding grass growth and quality across N.I. Since 2005, 7 and 14 day grass growth rate forecasts have also been published to assist farmers in planning grazing management.

Location of GrassCheck Pilot Farms

GrassCheck Monitoring

The main GrassCheck plot data is generated from four sets of monitored plots, managed under a simulated grazing regime, located at AFBI Hillsborough and CAFRE Greenmount. Plots are located on established perennial ryegrass swards and receive 270 kg N/ha, as there is no return of animal manures. Plots are cut on a three week rotation. Grass growth forecasts are generated weekly using the AFBI GrassCheck model with inputs of rainfall, solar radiation, temperature forecasts and planned nitrogen application.

Currently 20 commercial dairy farms, 21 beef farms and 5 sheep farms are monitoring grass growth and quality throughout the grazing season. These farms span a range of land types (from severely disadvantaged areas to prime lowland) and production systems. Weekly grass growth data is recorded across their grazing platform and entered onto AgriNet, with grass quality was measured fortnightly. Each farm is equipped with an automatic weather station, providing measures of temperature, solar radiation, soil temperature and moisture content, rainfall and wind.

Information is published weekly in the local farming press, online (agrisearch.org/grasscheck) and on social media (Facebook and Twitter, @GrassCheck).

Turnout Date

Early turnout of cattle to grass is critical to good grassland management. DAERA and AgriSearch funded research undertaken at AFBI, Hillsborough has clearly shown improved animal performance by turning both finishing and store cattle out to pasture early. In one study continental bullocks turned out to pasture 6 weeks earlier i.e. on 14 March, produced carcasses 23 kg heavier than their counter parts which remained indoors on grass silage and concentrates until 2 May (Table 1). Taking an average carcass price of £3.30, this equates to an additional £76 per head. In another more recent study, store bullocks turned out to pasture 3 weeks earlier on 5 April were 23 kg live weight heavier at housing than their counterparts which remained housed until 22 April (Table 2). Following a second winter finishing, differences due to turnout date were reduced to 8 kg live weight or 5 kg carcass weight. Taking an average carcass price of £3.30, this

equates to an additional £17 per head. These results indicate that turning cattle out to pasture u p to 6 weeks early in spring can offer substantial economic benefits in beef production. In addition to improved animal performance, early turnout reduces production costs by reducing the requirement for winter feed as well as the volume of slurry to spread.

Table 1. Effect of turning finishing beef cattle out to pasture early in the spring on subsequent performance

	Group		Early vs late turnout
	Early turnout	Late turnout	
Date turned out to pasture	14 March	2 May	6 weeks
Average slaughter date	4 August	4 August	
Slaughter weight (kg)	661	634	+27 kg
Carcass weight (kg)	370	347	+23 kg
Carcass value (£)	1221	1145	+£76

Table 2. Effect of turning store cattle out to pasture early in spring on performance

	Group		Early vs late Turnout
	Early turnout	Late turnout	
Date turned out	5 April	22 April	+17 days
Housing live weight (kg)	538	515	+23 kg
Slaughter weight (kg)	674	666	+8 kg
Carcass weight (kg/day)	373	368	+5 kg
Carcass value (£)	877	865	+£17

Housing date

Although the dry matter content of autumn grass can be low, if grazing has been well managed during the main grazing season the energy and protein content can be as high as that of average quality grass silage. A recent DAERA and AgriSearch funded project undertaken during autumn/winter 2018/19 compared the performance of spring born weaned suckler calves either rotationally grazed during the autumn or housed and offered average quality grass silage (Table 3). Both groups

were supplemented with 2 kg per head of concentrate daily. Performance during this period and indeed from weaning to turnout was similar for both groups (0.81 and 0.89 kg/day, and 0.95 and 0.94 kg/day respectively); however daily feed cost during this period was £0.62 per day cheaper for the grazed calves relative to the housed calved. Hence, extending the grazing season with weaned calves provides an opportunity to increase grass utilisation and lower production costs. However, overall the ability to extend the grazing season is very dependent on weather and ground conditions.

Table 3. Effect of extending grazing into autumn on suckler weanling performance

	Treatment		Grazed vs housed
	Grazed	Housed	
Housing date	29 Oct	23 Jan	+ 86 days
29 Oct weight (kg) (weaning)	228	228	
23 Jan weight(kg)	294	300	-6 kg
28 Feb weight (kg) (turnout)	339	339	
Daily feed cost (£/day)	1.14	1.76	- £0.62

Sward Quality

During the grazing season it is essential to manage the stocking rate in line with grass growth to ensure cattle have access to a high-quality grass sward. This is best achieved by ensuring grass growth equals grass demand. Latest information on grass growth is published weekly in GrassCheck. Grass quality depends on the stage of maturity of the plant which can be determined from the height of the sward. As grass grows the proportion of stem within the plant increases. A sward of long stemmy grass has a lower nutritive value and is less palatable than a short green leafy sward. Grazing the sward down tight in the early grazing season minimises seed head production and promotes a leafy sward for the rest of the season. Maintaining appropriate sward heights to maximise grass utilisation and animal growth potential are more easily achievable in a rotational grazing system compared to set stocking system, as paddocks can be taken out for silage production during periods of high grass growth. In a rotational grazing system, to achieve maximum levels of gain with high levels of grass utilisation, swards should be grazed down to 1600 kg DM/ha during spring – early summer, increasing to 1800 kg DM/ha in autumn.

Supplementing Holstein bull calves with concentrate at pasture

A DAERA and AgriSearch funded project undertaken during summer 2017 compared the performance of supplementing both autumn and spring born Holstein bull calves with 0, 2 or ad libitum concentrates at pasture. Calves were rotationally grazed in 7 day paddocks, with the grazing duration being 90 and 138 days for autumn and spring born calves, respectively. After housing bulls were offered ad libitum concentrates and grass silage. Autumn born bulls were slaughtered on average after 188 days and spring born bulls were slaughtered on average after 234 days. Performance of the animals through to slaughter is presented in Table 4. Compensatory growth during the finishing period was seen in the 0 or 2 kg supplemented bulls. Supplementing autumn born bulls at pasture did not give an economic return. However, supplementing spring born bulls with 2 kg concentrate at pasture did give an economic return relative to unsupplemented bulls. Although ad libitum concentrate supplementation at pasture resulted in higher performance the substantially higher total concentrate cost outweighed this benefit.

Table 4. Performance of Holstein bulls offered 0, 2 kg or ad libitum concentrates at pasture

	Autumn born bulls				Spring born bulls		
	Concentrate level (kg/d)				Concentrate level (kg/d)		
	0	2	Ad lib		0	2	Ad lib
Turnout live weight (kg)	196	196	196		107	107	107
Housing live weight (kg)	279	299	346		195	224	275
Slaughter live weight (kg)	579	579	622		522	566	604
Carcass weight (kg)	299	292	320		262	289	308
Total concentrate fed (t)	1.58	1.62	2.25		1.41	1.67	2.06
Carcass value minus feed cost (£/head)	309	289	202		271	299	277

This study highlighted an opportunity to include a grazing period in Holstein bulls slaughtered under 16 months of age. It is important to have high levels of Health and Safety when grazing bulls, including having secure fencing and adequate facilities for safe systems of work. A previous study at AFBI compared 6 month old autumn-born dairy origin bulls grazed in a continuous stocking system with

a buffer area, either unsupplemented or offered 2kg concentrates per head per day. This type of set stocking was used to improve both the grass utilisation and grass quality of a very open sward and involved weekly topping of 20% of the grazing area from the beginning of May. Bulls were turned out on 10th April and housed on 4th August 2014. Supplementation at grass did not improve the performance of the bulls (Table 5). The unsupplemented set-stocked bulls were settled since they did not anticipate being fed concentrates or moving to a fresh paddock.

Table 5. Performance of grazing set stocked Holstein bulls

	Unsupplemented	Supplemented with 2kg concentrates/ head/ day
Live weight at turnout (kg)	174.1	173.9
Live weight at housing (kg)	303.7	309.2
Live weight gain (kg/d)	1.12	1.17

Nitrogen fertiliser application rate

The average utilisation of grass in beef and sheep farms in Northern Ireland is 4.1t DM per ha, which is well below what many farms are capable of producing. Previous AFBI research indicated that increasing the yield of grass by 1 t DM per ha could improve margins on beef farms by £218 per ha. The average usage of nitrogen on beef and sheep farms in the UK is 94kgN/ha. A recent study undertaken at AFBI Hillsborough during 2018, evaluated a range of N fertiliser rates (0, 90, 180 and 270 kg N/ha) on grass growth and quality. The plots receiving 0 kg N per ha yielded an average of 6.7 t grass DM per ha. Application of 90, 180 and 270 kg N per ha increased grass yield to 8.8, 10.9, 12.1 t DM/ha which represents a 31, 61 and 80% increase in grass production. Similar responses were recorded on GrassCheck farms (Figure 1).

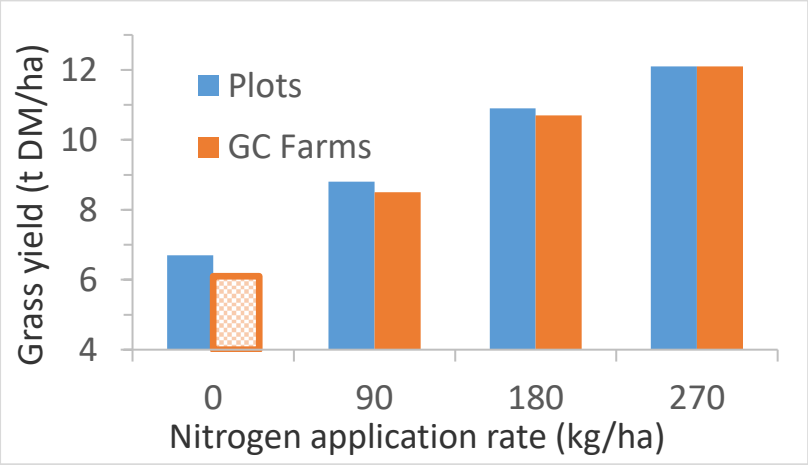


Figure 1. Grass response to varying N application rates on plots and GrassCheck farms

Summary

- Well managed grass is a highly nutritious feedstuff for beef cattle
- Early turnout of cattle to grass is critical to good grassland management
- Potential opportunity to extend grazing season with light cattle
- Opportunity to introduce grazing period for Holstein bulls
- Supplementing autumn born bulls with concentrates does not give an economic return
- Supplementing spring born bulls with 2 kg concentrates did give an economic return compared with unsupplemented bulls
- Increasing N fertiliser application by 90, 180 and 270 kg N per ha increased grass yield by 31, 62 and 80% relative to zero N application, which yielded 6.7 t DM/ha.

Soil Structure: An indicator of potential productivity

Alex Higgins
Agri-Environment Branch

Introduction

Soil structure is critically important in determining the agricultural productivity of any soil. Factors such as water holding capacity, water movement, aeration and heat transfer are all strongly influenced by soil structure. For any given soil type, all other factors being equal, the presence of well developed, open soil structure will always lead to better crop growth than if a soil is highly consolidated.

What is Soil Structure?

Over time all topsoil particles will tend to bind together into units of various sizes. The size and degree of development of these units will be controlled by the physical composition of the soil (percentage distribution of sand, silt and clay particles), the organic content of the soil, the nutrient status of the soil and the land use that the soil undergoes. Structural units form into a number of specific recognizable geometrical shapes; the four most common are illustrated in Fig 1.

Fig.1. *Photographs of soils showing common structural characteristics*

Assessing Soil Structure

A visual examination of the existing soil structure within a field is a quick way of estimating the health and potential productivity of your soil. Although this can be carried out at any time of the year, the structural units are most easily identified when the soil is moist. Normally at least 3 inspection pits are required to get a representative picture for a field (more in a large field), or where there is a range of soil types or soil conditions. A square block, 40cm x 40cm x depth of the topsoil is removed with a spade and examined.

The first thing to look for in the excavated block is the general soil colour. Well aerated topsoil will have a strong brown colour; poorer aeration will result in more grey colours or rusty discoloration being present. Next, note the presence of voids (either fissures between the soil structural units or pores within the units). Soil with good, well developed structure will have a high percentage of voids, allowing good drainage, aeration, root growth and general biological activity. The final step is to look at the structural units, by gently teasing the soil apart by hand. In Northern Ireland, if structure exists in the topsoil, it will fall within the following 4 classes:

- Granular (Fig. 1a): Small spherical units, highly porous, root development throughout. Mostly found on freely draining soils or under long term pasture.

- Sub-angular (Fig. 1b): Blocks with curved or rounded sides, porous, root development throughout. Found widely throughout all types of soil.

- Angular (Fig. 1c): Blocks with flat sides, reduced porosity, root development around the blocks or concentrated in large pores. This can develop in heavy, imperfectly drained soils.

- Platy (Fig. 1d): Blocks with horizontal, flat sides, root development can be very restricted. This can develop in any soil as a result of compaction.

Soil Compaction

All productive soils require a degree of compaction to ensure good contact between plant roots and soils to maximise uptake of water and nutrients. 'Soil compaction' occurs when soil particles are consolidated beyond an optimum level as a result of an applied force. As a consequence, soil bulk density is increased making root penetration difficult, and soil pore volume is decreased, reducing soil aeration, water infiltration and natural drainage. These changes can reduce grass yield by up to 25%, and also decrease fertiliser efficiency and increase surface runoff, soil erosion and gaseous emissions of nitrous oxide and ammonia.

Causes and identification of Compaction

In Northern Ireland soil compaction is mainly due to vehicle traffic, animal treading, and cultivation operations all of which can damage the soil structure. Virtually all soils are vulnerable to some form of soil compaction under the right combination of circumstances. The most important factor is of course soil moisture; the wetter a soil the lower its capacity to withstand compression. There are two main visual indicators of soil compaction: (1) the appearance of new wet spots in fields after rainfall; and (2) variations in grass growth across fields, often in zones of heavy trafficking. However, the most reliable method of identifying soil compaction is to open inspection pits and examine the soil structure.

Key messages

Maintenance of good soil structure should be a key consideration in day-to-day farm management as healthy soils promote plant growth and efficient use of applied nutrients.

The most cost effective way of preventing soil compaction is to adopt management strategies which reduce the risk of soil damage:

- Match operations to the nature and conditions of the soil
- Reduce axle loads, if possible to < 5t
- Reduce ground/tyre pressure
- Use a controlled traffic system – use lane-ways for livestock etc.

Phosphorus MANAGEMENT on Beef and Sheep Farms

Dr John Bailey
Agri-Environment Branch

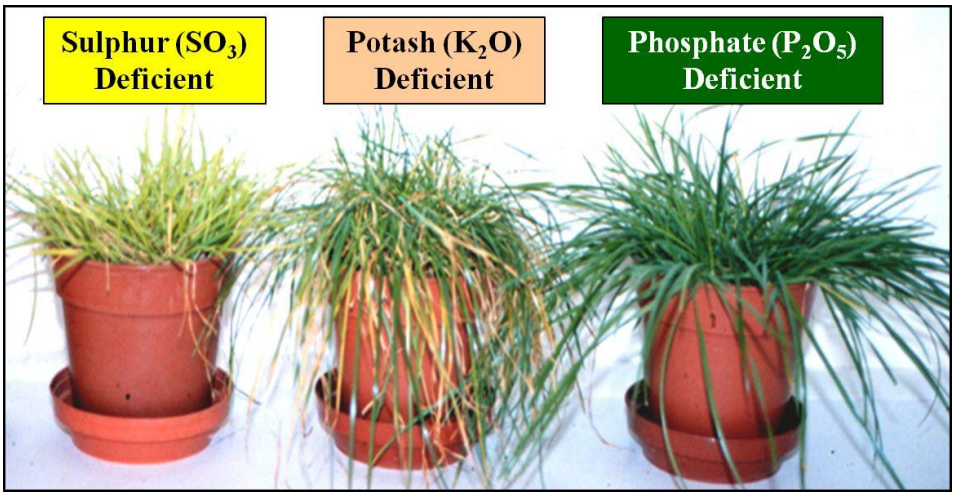
Introduction

Chemical fertilisers and manures need to be applied to grow swards for cutting or grazing. Unfortunately, very few grassland farmers soil-test, and therefore most are completely 'in the dark' regarding the nutrient status of their soils.

A recent AFBI soil survey of more than 500 grassland farms across Northern Ireland indicated that more than 40% of fields, across all classes of farmland, are over-supplied with phosphorus (P). In some situations this has occurred because expensive NPK compound fertilisers have been applied routinely to cut or grazed swards, even though more than enough P has been present in soil and/or slurry to meet crop requirements. In other cases, P-containing fertilisers have been targeted at under-performing fields in the mistaken belief that these are suffering from phosphate deficiency.
It is **highly unlikely** that under-performing silage swards are being curtailed by phosphate deficiency. Provided phosphate in slurry is being recycled back to cutting land, there ought to be more than enough in both soil and manure to meet crop requirements without the need for additional fertiliser phosphate.

Yellow grass does NOT indicate phosphate (P_2O_5) deficiency!

If adequate nitrogen (N) is being applied to swards, under-performance could be due to sulphur (SO_3) or even potash (K_2O) deficiency. Farmers often assume that yellowing of swards is symptomatic of phosphate deficiency, when in fact it is almost certainly the result of either sulphur or nitrogen deficiency. Swards acutely deficient in sulphur are pale green to yellow; potash deficient swards have distinctive 'brown paper' discoloration of older leaves, whereas phosphate deficient swards are **DARK GREEN** – not yellow.



Phosphate-deficient grass is neither yellow nor brown - it is dark green

Protect your industry!

Over-use of phosphate-containing fertilisers is one of the main reasons why Northern Ireland Agriculture is currently being regulated under the European Union's Nitrates Directive. Although use of phosphate fertilisers declined dramatically from 2000, in the last 5 years it has increased again, and there is now evidence that water quality is deteriorating and jeopardising Northern Ireland's Nitrates Action Programme and derogation.

To protect the farming industry and the environment, and prevent further regulation, farmers must manage nutrient inputs wisely and responsibly, and only use phosphate-containing fertilisers when there is definitely a phosphate requirement that cannot be met using organic manure.

New phosphorus recommendations for extensive grassland in NI

Grassland managed 'extensively' with relatively low N inputs, should have lower P requirements and a lower target soil P level than grassland managed 'intensively' with high N inputs driving high levels of grass production and P removal.

It is proposed that for grassland managed extensively and receiving less than 60 kg N/ha/yr as chemical N and with a manure N loading of less than 120 kg N/ha/yr (supporting grazing and one cut of silage or hay per season), the target soil P index should be 2- (16-20 mg P/l) and the following P recommendations should apply:

Table 1. Maximum phosphate fertiliser application limits (kg P_2O_5 per ha) for extensively managed grassland (< 60 kg chemical N/ha/year and < 120 kg manure N loading per annum)

	Soil P Index					
	0	1	2-	2+	3	4
Grass establishment	80	65	50	30	0	0
Grazed grass (whole season)	50	35	20	0	0	0
First cut silage †	70	55	40	0	0	0
Hay †	55	43	30	0	0	0

† If silage or hay crops receive > 80 kg N/ha/year the P recommendations below apply:

	Soil P Index					
	0	**1**	**2-**	**2+**	**3**	**4**
First cut silage	100	70	55	40	0	0
Hay	80	55	43	30	0	0

The above recommendations have been included in the 2019-2022 Nutrients Action Programme (NAP)

Key messages

- Don't apply phosphate (P_2O_5) fertiliser if you don't need it!
- Yellow grass does NOT indicate P_2O_5 deficiency!
- Extensively managed grassland requires less P_2O_5 than intensively managed grassland

Potash MISMANAGEMENT on Beef and Sheep Farms

Dr John Bailey & Dr Suzanne Higgins
Agri-Environment Branch

Introduction

Potash deficiency is common in Northern Ireland (NI). A recent survey by AFBI of 500 farms (12,000 fields) across NI has indicated that 26% of fields on beef farms and 33% of fields on sheep farms were found to be *under-supplied* with potassium (K) (soil ≤ Index 1). Potash deficiency can result in significant losses in grass production. Optimising potash inputs are essential, particularly in spring when growth rates are high. However, it is important not to over-supply potash as this can result in animal health concerns. An over-supply of K (> Index 2+) was found in 25% of fields on beef farms and 18% of fields on sheep farms in 2017/18.

Fig.1. *Potash-deficient swards*

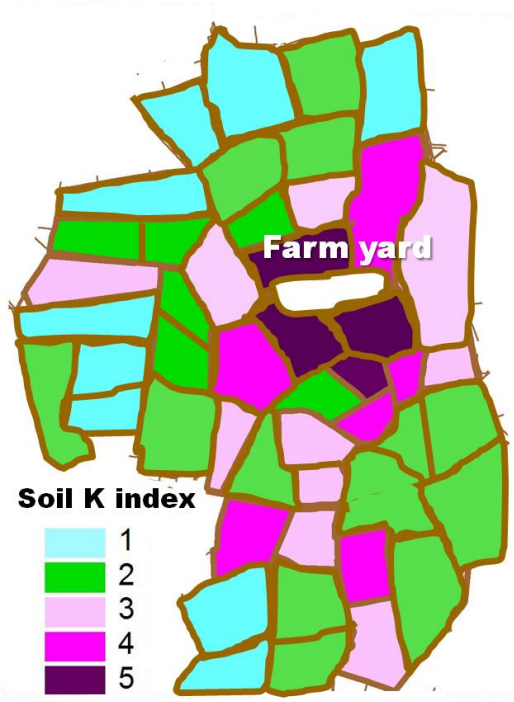


Fig.2. *Soil K indices on a typical farm*

Knowledge of potash levels in soil is essential

Without a soil test every 4-5 years, K deficiency is not easy to identify. Yield losses can occur without any recognisable visual symptoms. However, when symptoms do occur, more than 40% of dry matter yield may already have been lost. Under more severe K deficiency conditions the edges and tips of older leaves develop a characteristic paper-brown coloration (Fig. 1). A grass silage crop can remove up to 30 kg of potash per tonne of grass dry matter harvested. Slurry is a useful source of K and can provide a large proportion of potash requirements at relatively low cost. There is a tendency to apply slurry more often to fields closest to farmyards, thereby causing an excessive build-up of potash in these soils (K index 4-5), while fields further away receive little or no slurry and become potash-depleted (K index 1) (Fig. 2). Province-wide, applying additional K as slurry or fertiliser to fields that are low in K could result in 400,000 tonnes extra grass dry matter, worth up to £40 million to the industry.

Grass requires large amounts of potash to make efficient use of nitrogen

Fertiliser nitrogen (N) cannot be utilised efficiently if potash supplies are inadequate. When potash inputs to grassland are insufficient, uptake and utilisation of fertiliser nitrate-N will be restricted. Both nutrients need to be simultaneously available to swards in large amounts if full yield potential is to be achieved. If nitrate is not taken up but remains in the soil, there is a risk that it will be leached into waterways and give rise to algal blooms, or else be converted into the potent greenhouse gas nitrous oxide (N_2O).

Potash overuse can be detrimental to the health of dairy cattle

Excessive use of potash (as fertilisers or manure) on pastures has been associated with grass tetany (hypomagnesaemia) in dairy cattle. This condition develops when insufficient magnesium (Mg) is absorbed from the diet. Luxury uptake of potash by swards on potash-enriched soils can reduce Mg uptake. Excessive concentrations of potash in grass and forage also reduces the ability of cattle to absorb Mg. Lactating cows are particularly susceptible to this condition in early spring.
Milk fever (Hypocalcaemia**)** is also linked to excessive concentrations of potash in dairy cow diets. Dry cows fed forages containing moderate to high levels of potash can be susceptible to milk fever following calving, since the previous excess intake of dietary potash pre-calving hinders their ability to absorb Mg, which in turn is needed by the parathyroid gland to control blood calcium levels. Excessive levels of dietary potash can also induce metabolic alkalosis in dry cows, thereby reducing their ability to maintain blood calcium levels in early lactation. 'Luxury' uptake of potash by forages

largely results because of potash being applied to grassland without knowledge of the soil potash status. Applying potash on the basis of soil test information will produce forages with lower (yet adequate) concentrations of potash thus reducing the risk of tetany and milk fever in cattle.

Let the soil feed the crop, and add fertiliser and manures to feed the soil

Potash reserves in soil are more effective at supplying plants than fresh fertiliser applications. Potash depleted soils (K index 0 and 1) will often fail to produce the same yields as fertile soils even if much higher rates of potash are applied. Adequate reserves of potash should therefore be maintained in the soil by using fertilisers and manures to replace what is removed by cutting or grazing. For soils with low potash reserves (K index 2 or less), extra fertiliser potash should be applied in the autumn to restore fertility to target levels. In contrast, where soils are overly enriched with potash (K index 4-5), fertiliser usage (and manure application) should be lowered or omitted to reduce the risk of grass tetany and milk fever in cattle.

Key messages

- Soil testing is essential to manage your potash levels.
- For soils with low potash reserves (K index 1 or 0), extra fertiliser potash should be applied in the autumn to restore fertility to target levels.
- Where soils are overly enriched with potash (K index 4 to 5), fertiliser K usage and manure application should be lowered or even omitted altogether to reduce the risk of grass tetany and milk fever in cattle.

Sulphur is ESSENTIAL to ensure high yields of good quality grass

Dr John Bailey & Dr Suzanne Higgins
Agri-Environment Branch

Introduction

Sulphur deficiency in grass swards remains a high risk in NI, particularly on light sandy / free draining soils, but is also prevalent in heavier textured clays and clay loam soils. Sulphur deficiency manifests as a uniform yellowing or paling of grass shoots across all ages of leaf tissue, coupled with a loss of yield. It is particularly prevalent in spring. Sulphur deficiencies can reduce grass yields by as much as 30%, representing a significant economic loss to farmers. By investing in S containing fertiliser, farmers could prevent yield losses worth up to £90 per ha per cut, and provided a low-S containing fertiliser (i.e. with < 10% SO_3) is used, there should be no risk to animal health.

Fig.1. *S-deficient swards - showing uniform yellowing or paling of leaf tissue*

Sulphur deficiency impairs grass yield and feeding quality

AFBI research has shown that dry matter (DM) yield losses of up to 30% are now occurring at 1st cut or 1st grazing as a result of S deficiency, whereas in the 1980s and 1990s S deficiency was primarily a 2nd or 3rd cut phenomenon. Highly deficient swards appear pale yellow-green in colour (Fig. 1), but up to 20% of DM yield may be lost without any recognizable visible symptoms in the herbage. Not only does S deficiency significantly hamper grass DM production, it also reduces its feeding value. Sulphur

has a vital role in protein production, being a core element in two of the essential amino acids that make up the building blocks of protein. Under S deficient conditions, the true protein content of grass declines, and this not only reduces its value as protein source for ruminants, it also hampers its ability to accumulate sugars and thus impairs its fermentation quality when ensiled. A shortage of S in herbage can also reduce the digestibility of forages. Rumen microbes require both nitrogen and S to produce their own protein, and a shortage of S will hinder this process thereby curtailing important metabolic functions.

Don't rely on slurry to meet the sulphur requirements of forage crops

The apparent underuse of S fertiliser on grassland may be due in part to the assumption that slurry applications provide enough readily available sulphate-S to meet the needs of silage crops. In theory, a 33 m^3/ha (3000 gallons/acre) application of 6% DM cattle slurry to silage swards will supply 26 kg SO_3/ha, which is close to the 25–40 kg SO_3/ha required for one crop of silage. But the availability of slurry S to crops is highly variable and often low, largely because variable amounts of sulphate are converted into sulphide (a potential plant toxin) under anaerobic slurry storage conditions. Consequently, in the latest edition of the RB209 Fertiliser Manual, it is recommended that S inputs from manures should only be regarded as contributing to the maintenance of soil S reserves and not to the needs of subsequent silage crops.

The soil sulphur test can be unreliable

For highly 'mobile' soil nutrients such as sulphur, the winter/spring soil test only indicates the amount of nutrient available in the soil at the time of testing. If a prolonged period of wet weather occurs following soil testing, much of the sulphur may be washed out of the soil and into land drainage water. In such circumstances, herbage analysis may be used as a 'back-up' to diagnose sward S status early in the season (mid-April) and provide an early warning of S insufficiency which may be corrected in the April top-dressing or when applying fertiliser for subsequent silage crops.

Apply sulphur-containing fertilisers routinely to all grassland

Given that S deficiency can occur in spring on all soil types, regardless of the soil S test result, and regardless of whether or not slurry has been applied, S-containing fertilisers ought to be applied routinely to all grassland at the start of the season. Silage

and grazed swards on light textured sandy soils should receive fertiliser sulphur for both 1st and 2nd cut crops and for 1st, 3rd and 5th grazings (*even if slurry has also been applied*) at a rate of 2.5 kg SO_3 for every 10 kg N applied, using an NS or compound fertiliser with less than 10% SO_3. Silage and grazed swards on heavier textured clays and clay loam soils should receive fertiliser sulphur for 1st cut and 1st grazing only (*even if slurry has also been applied*), at a rate of 3.5 kg SO_3 for every 10 kg N applied, using an NS or compound fertiliser with less than 10% SO_3.

Key messages

- Silage and grazed swards on light textured sandy soils should receive fertiliser sulphur for both 1st and 2nd cut crops and for 1st, 3rd and 5th grazings (*even if slurry has also been applied*) at a rate of 2.5 kg SO_3 for every 10 kg N applied, using an NS or compound fertiliser with less than 10% SO_3.
- Silage and grazed swards on heavier textured clays and clay loam soils should receive fertiliser sulphur for 1st cut and 1st grazing only (*even if slurry has also been applied*), at a rate of 3.5 kg SO_3 for every 10 kg N applied, using an NS or compound fertiliser with less than 10% SO_3.

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How to Choose a Method of Sward Improvement

There are several methods of improving swards, which can be subdivided into three categories.

- **Sward replacement or reseeding**

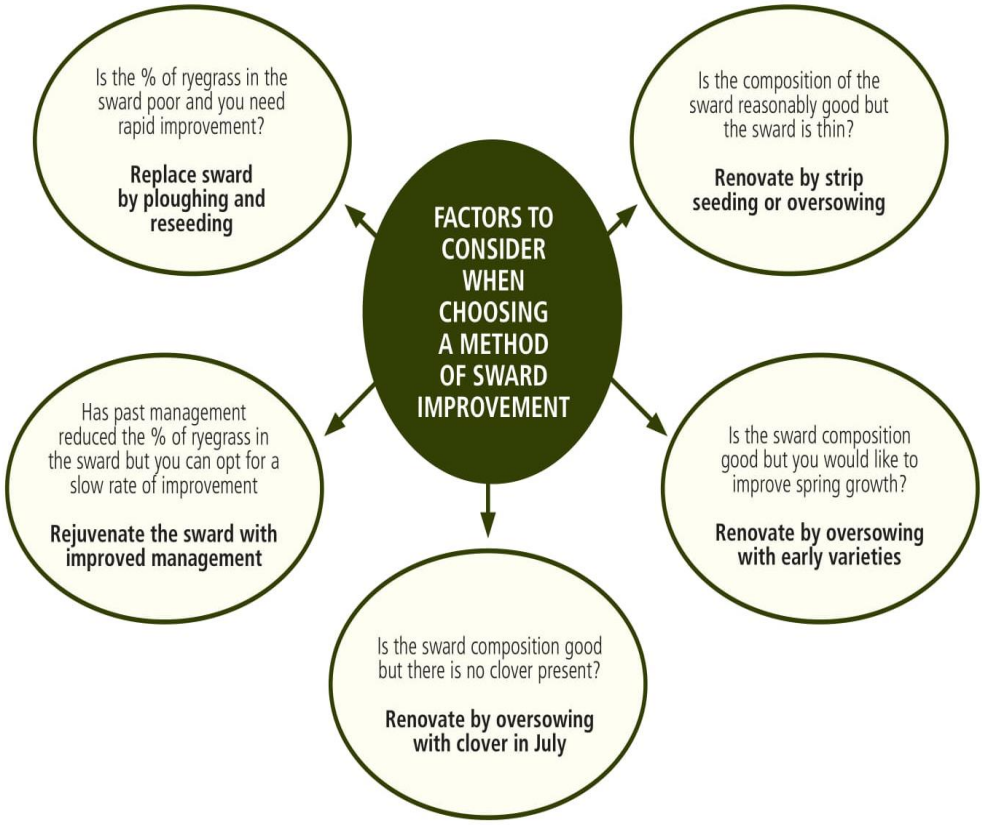
This involves the destruction of the old sward and its replacement by a completely new reseed. This can be accomplished by either ploughing or by using minimal cultivation techniques.

- **Sward renovation or stitching in**

This involves introducing seed into an existing sward without cultivation by overseeding, slot seeding or by minimal cultivation techniques.

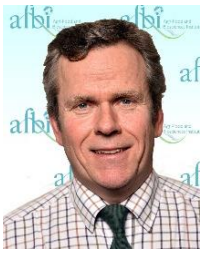
- **Sward rejuvenation**

This involves gradual improvement brought about by the general improvement in management e.g. use of lime, better use of nitrogen and other nutrients or improved grazing management.



Implications of Ryegrass Seed Mixtures on Sward Productivity

David Patterson – AFBI Agriculture Branch



Key messages

- *Perennial ryegrass remains the dominant component of seed mixtures but different combinations of ploidy and maturity change how the sward will perform*
- *Mixtures with a wide spread of ryegrass heading dates flattens yield distribution across the season and between years and suits grazing systems*
- *Mixtures with a narrow spread of ryegrass heading dates helps optimise the yield-quality balance for silage production*
- *Varieties will compete and change in proportion after sowing, requiring mixture design to offset changes and give the required composition in the established sward.*

Background

Commercial grass seed mixtures typically have combinations of diploid and tetraploid perennial ryegrass varieties with each component variety having a specific heading date. The trend over recent years has been to have fewer varieties within mixtures and a higher proportion of tetraploid varieties used in grazing swards in particular. The design of mixtures involves combining varieties with different attributes to create a sward with a production capability greater than any individual variety. One of the most important factors in compiling mixtures is deciding how wide or narrow a spread in heading dates to build into the design. AFBI research has quantified the extent to which diploid to tetraploid ratio and heading date range impacts on sward performance.

Research findings

In a cattle grazing trial of different perennial ryegrass varieties joint AFBI-Teagasc research in 2014 found that tetraploid varieties were grazed off to a lower residual height than diploids and they had higher digestibility. They concluded that tetraploids

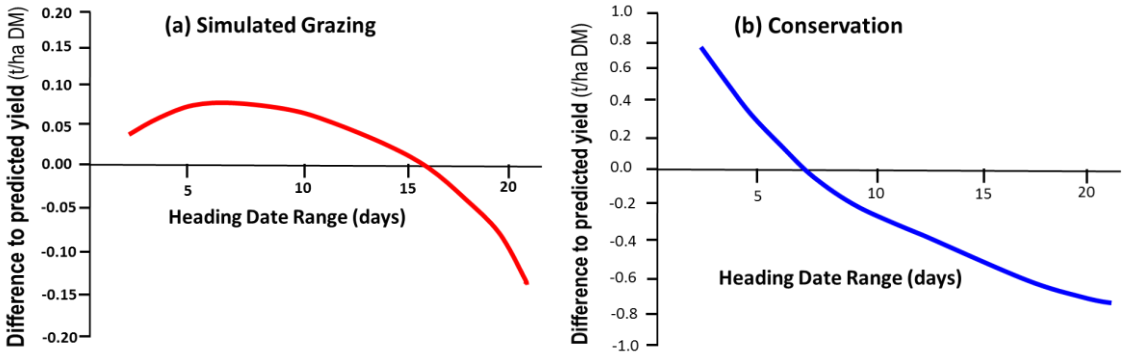
were being better utilised than diploid varieties, albeit the tetraploids had lower overall dry matter content.

An earlier AFBI study, investigated the dry matter yield performance of mixtures relative to their individual variety components, by tracking their proportions within the sward using a genetic test to measure each component. The tetraploid components within a range of diploid:tetraploid mixtures, was always found to be the more aggressive than the diploid varieties. This was not related to variety heading date but due to the resultant canopy structure of the tetraploid swards. Tetraploids have longer wider leaves than diploids, especially in comparison with dense growing diploids, which gives them a spatial advantage in the sward canopy. This means that tetraploids tend to increase in proportion from their sowing ratio, mostly within the first full growing season. This also highlighted that the utilisation of any variety under grazing is a vital assessment to build into any decisions on what varieties perform best on farm.

A third more recent review study investigated the impact of differences in variety maturity (heading date) using commercial seed mixtures managed under simulated grazing and conservation cutting regimes.

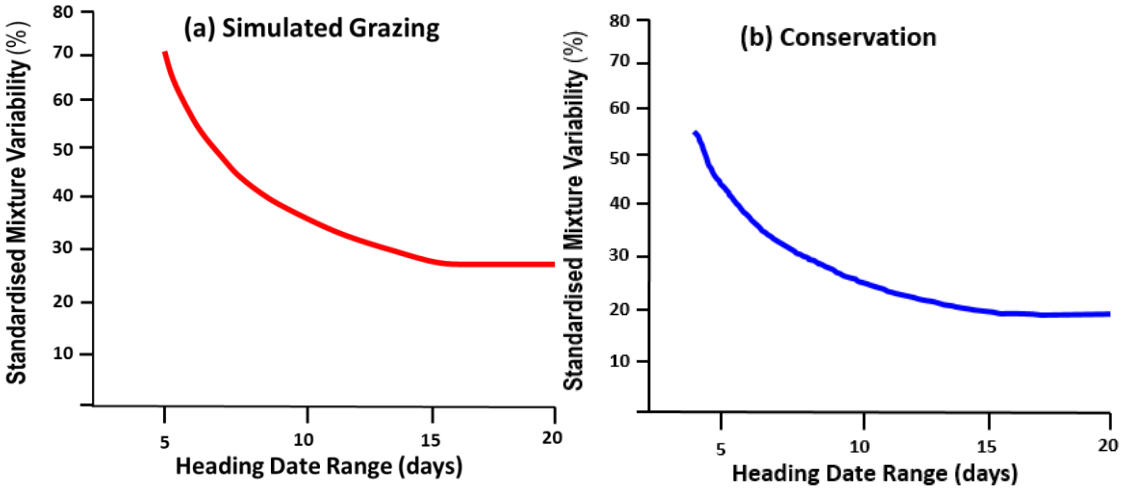
The outcome of the study was that when the component perennial ryegrass varieties had too wide a spread of different heading dates, the yield was negatively impacted. If the spread of heading dates was more than 7 days under a silage management, yield was depressed as it was more difficult to retain a high grass quality as the sward bulked up to the first cut. There was more 'flexibility' under grazing management as yield was not affected until the heading range between varieties was more than 15 days.

Figure 1: Yield differences between predicted and actual mixture yields as a function of the heading dates range



Furthermore, mixtures with a heading date range of 7 - 15 days showed a benefit in better distributing the yield across the grazing season and a lower year-to-year variation in dry matter yield, (Figure 2).

Figure 2: The relationship between the heading date range of commercial mixtures and the annual variation in yield



In all these studies it was found that the mixtures changed from their seed bag proportions after they were sown. This occurred largely in the first full growing season and in addition to the changing proportion of diploid to tetraploid, the earlier heading varieties tended to be more dominant in silage swards and less aggressive in grazing swards compared to the later heading varieties.

Farming guidance

The management implications of these findings are that: limiting heading date range is more critical under silage management than grazing; there is better year to year yield stability with a range of heading dates; tetraploids will be more aggressive than diploids in the mixed sward, with 30% tetraploid at sowing resulting in approximately 50% in the sward. Therefore, seed mixtures are designed to offset the competitive diploid:tetraploid and earlier:later heading interactions to produce swards with the desired final proportion of varieties for the intended sward use. Farmers should therefore have a clear understanding of what they expect their new sward to provide in terms of silage timing or grazing seasonality, so that the seed merchant or advisor can identify the correct compilation for that use.

How best to measure grass

For further information please contact Graeme Campbell, CAFRE.

Grass growth and animal requirement vary throughout the growing season causing fluctuations in supply and demand for grazing stock. This makes it essential to regularly assess how much grass is available for grazing stock and prepare grass budgets through the season.

Budgeting combines current grass covers with projected grass growth rates. It is a planning tool identifying periods of potential grass surpluses or shortages for a group or groups of grazing livestock. This matching of supply to demand helps ensure a high utilisation of quality grass from grazing swards.

Grass growth rate

The universally accepted measurement of grass quantity is kilograms of dry matter per ha (kg DM/ha). Dry matter is the total yield of grass minus the water content.
Daily grass growth rates vary from 5-15 kg DM/ha in February/March to 60-100 kg DM/ha in May/June. Sunlight, temperature and rainfall all affect grass growth. Other factors that affect grass growth, over which the farmer has control, are fertiliser application rates, length of grazing rotation and poaching damage.

Assessing the amount of grass available - grass cover

Grass cover is the average quantity of grass in kg DM/ha to ground level and includes the grass available for grazing and that which will be left after grazing. In this booklet grass covers are presented to ground level, this should not be confused with grass cover in the Republic of Ireland, which refers to grass available over 4 cm in height. A number of methods have been developed to assess grass cover.

I) Sward assessment using a rising plate meter

A rising plate meter can be used to measure grass covers until sufficient experience is gained by visual assessment. It relates pasture height and density to yield through a carefully calibrated equation. The rising plate meter consists of a thin aluminium plate connected to a shaft by a gear linked to a read out of grass height. A mechanical counter records the number of readings from an area.

As the rod is lowered into the pasture, the plate is supported at a height determined by the sward's density and height. Target grass covers are set pre- and post-grazing for various times during the grazing calendar and for different types of stock.

How to use a rising plate meter

1. Set the top counter of the rising plate meter to 0 and record the opening reading (A) on the rising plate meter before you start.

2. Walk through the sward in 'W' pattern, taking up to 40 measurements at equal distances apart (for example, every five steps), to ensure a uniform distribution of the sward is measured. While walking through the sward make sure to record the number of readings taken by clicking the top counter. Sampling is done at random across the grazing area, so dung pats are eligible for measuring, and the only areas to avoid are poached and rutted areas. On slopes keep the plate meter vertical.

3. After walking through the sward, record the number of readings taken and the closing reading (B) on the rising plate meter.

4. Use the equation below to calculate grass cover (kg DM/ha):
Closing reading (B) - Opening reading (A) x 125 + 640 kg DM/ha
Number of readings (C)

5. To calculate the quantity of grass present in the whole paddock multiply the DM yield of each paddock by the area of the paddock in ha.

6. This should be repeated for all the paddocks that are intended for grazing. Do not measure paddocks that are likely to be cut as silage or grazed by other stock.

7. By adding all the individual paddocks that are to be grazed together, and dividing by the overall total area in ha, the average farm cover present within the grazing area is calculated.

II) Visual assessment by walking the pastures

Assessing the sward height alone is not a true reflection of grass yield. When visually assessing swards or 'eyeballing' as it is often called, sward height and density must be considered. Dense swards, for example a ryegrass/clover sward grazed regularly by sheep will contain a greater amount of grass than an erect open sward grazed by cattle at the same height. Estimating grass cover in a field can be difficult when swards are grazed unevenly as a result of poaching, spoilage and/or contamination with urine or dung.

However, with experience an overall average can be assigned to the field.
Examples of grass covers are presented in the photographs below. The wellie boot has been used by farmers as a rough guide to assessing grass covers.



Figure 1. **1300 kg DM/ha** **3000 kg DM/ha** **4000 kg DM/ha**

Calculating grass supply

Grass supply or available grass cover is the amount of grass various groups of stock are offered. To calculate how much grass is on offer and available to the stock the estimated quantity of grass left after grazing (post grazing) must be subtracted from the total measured amount of grass in the field before grazing (pre-grazing). This is explained in the following calculation:

grass supply or "available grass cover"
= (pre-grazing cover – post-grazing cover) x grazing area (ha)

Target grass covers are set pre- and post-grazing for various times during the grazing calendar and for different types of stock.

Typical pre-grazing and post grazing covers for different classes of livestock in the springtime are highlighted in Table 1. In order to maintain high grass quality it is important to ensure stock enter and leave the grazing areas at the target grass covers.

Table 1. Pre-grazing and post-grazing grass covers for different classes of livestock in the spring.

Class of Livestock	Pre-grazing kg DM/ha	Post-grazing kg DM/ha	Available grass kg DM/ha
Dairy	3300	1600	1700
Beef	3000	1600	1400
Grazing lambs	2100	1600	500

Stock demand for grass

The individual animal grass demand (kg DM/day) is estimated to be equivalent to 2.5% of the animals' liveweight in the case of beef cattle. Individual animal demand can vary from 1.75% to 3.25% of bodyweight, depending on stage of growth, however 2.5% has been found to be an acceptable average figure for calculation purposes.

For example, a 300 kg steer will have a daily grass demand of:
300 x 0.025 = 7.5 kg DM/day

In the case of March lambing ewes suckling 1.5 lambs, intake is estimated at 3.5% of bodyweight.

A ewe weighing 70 kg will have a daily grass demand of:
70 x 0.035 = 2.45 kg DM/day

The daily grass demand of a dairy cow will depend on size, milk yield and concentrate feed level. The group demand per day is calculated by multiplying the number of animals in the group by the individual animal demand. It is this information that allows the length of the grazing period in a particular paddock or area to be calculated.

GrassCheck

The DAERA and AgriSearch funded **GrassCheck** programme monitors the growth of grass swards on a range of sites throughout Northern Ireland.
In addition to this work a model has been developed that allows the prediction of grass growth for the next two weeks based on time of year, previous week's growth and forecasted weather conditions.This information is presented in weekly bulletins in the local farming press and on https://www.agrisearch.org/bulletins. These predictions can be used to manage grassland swards through the season and helps to prepare in advance for any surplus or deficits.

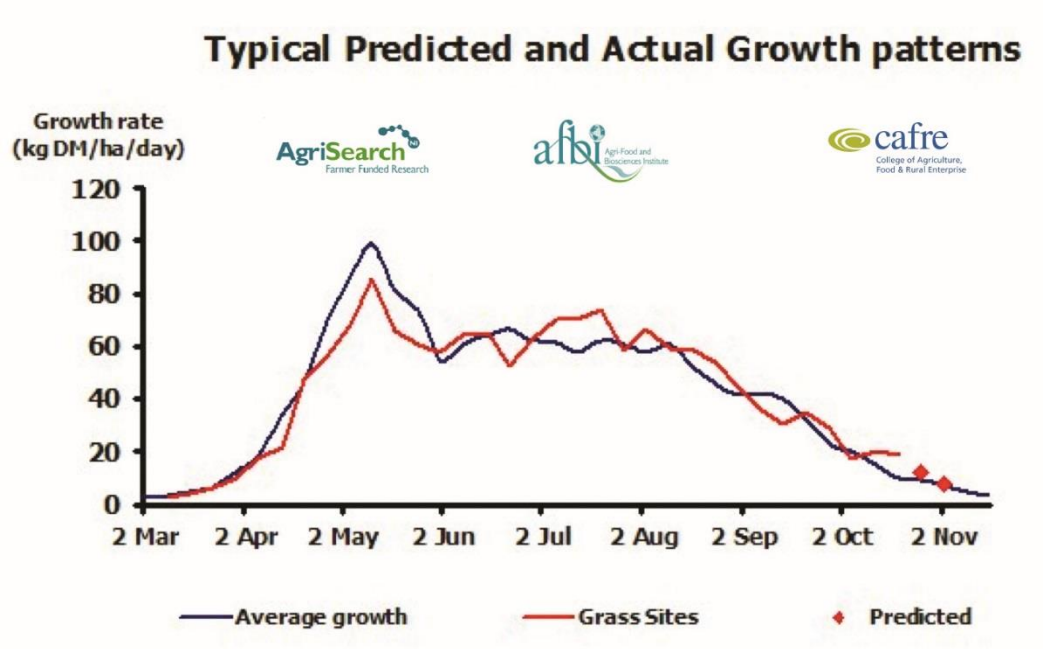


Figure 2. Graph showing actual and predicted grass growth as produced by GrassCheck.

Budgeting grass to meet demand

Information on grass growth, grass cover (supply) and stock grass intake (demand) may then be used to prepare a grass budget. A grass budget is simply a statement of grass supply and grass demand for the grazing stock.

Grass growth predictions such as those from **GrassCheck** can also be incorporated to forward budget grass supply. These variations in grass growth during the year require seasonal adjustment in stocking rates to ensure efficient grassland utilisation. Grass budgeting is particularly useful over a 2-3 month period in spring and autumn when grass growth rates are increasing or declining quite rapidly, or at any period when stock demand is changing significantly.

Developing a grass wedge through rotationally grazing around a number of paddocks or fields is a useful grassland management system. The grass wedge illustrates the quantity of grass available across the grazing platform. Areas are rested between grazings, allowing grass time to regrow.

Those grazing areas with the longest rest periods can be assessed weekly to identify when in the rotation grass surpluses or deficits are likely to occur. A line drawn from the target pre-grazing cover to the target post-grazing cover provides a guideline on surpluses and deficits.

Establishing a grass wedge by mid-April through turn-out from early March onwards will provide a breakdown of the grass available in each paddock on the farm. To build

the wedge the fields due to be grazed first in the spring should be the first to be closed off in the autumn.

The three grass wedge charts illustrate various scenarios on farm and outline the action that could be taken to correct the problem. In the three scenarios paddock 1 is the first field to be grazed in the rotation at a pre-grazing target cover of 3000 kg DM/ha and paddock 20 is the last field in the rotation with a post-grazing cover of 1600 kg DM/ha.

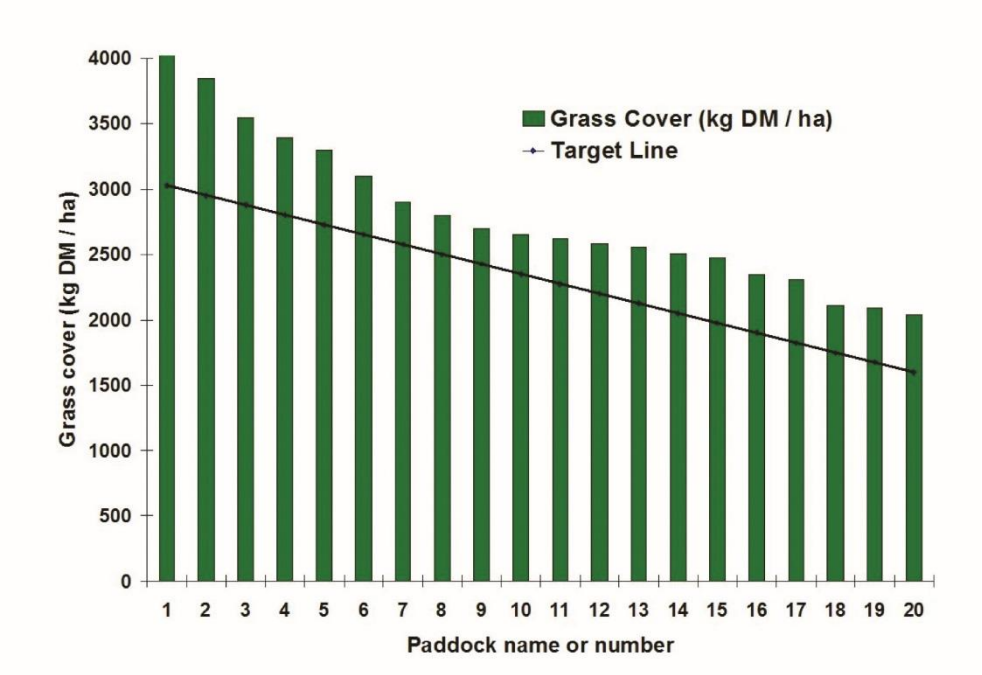


Figure 3. A grass wedge illustrating a surplus of grass across the grazing platform

In this scenario pre-grazing covers are too high and well above target as are post grazing covers. Action is required immediately. In most instances grass surplus to grazing requirements should be conserved for silage possibly as round bales.
Other stock such as replacement heifers could be introduced into the rotation to reduce covers. Higher covers are more difficult to graze off cleanly and will have a detrimental effect on spring grass growth due to the presence of dead material at the base of the sward.

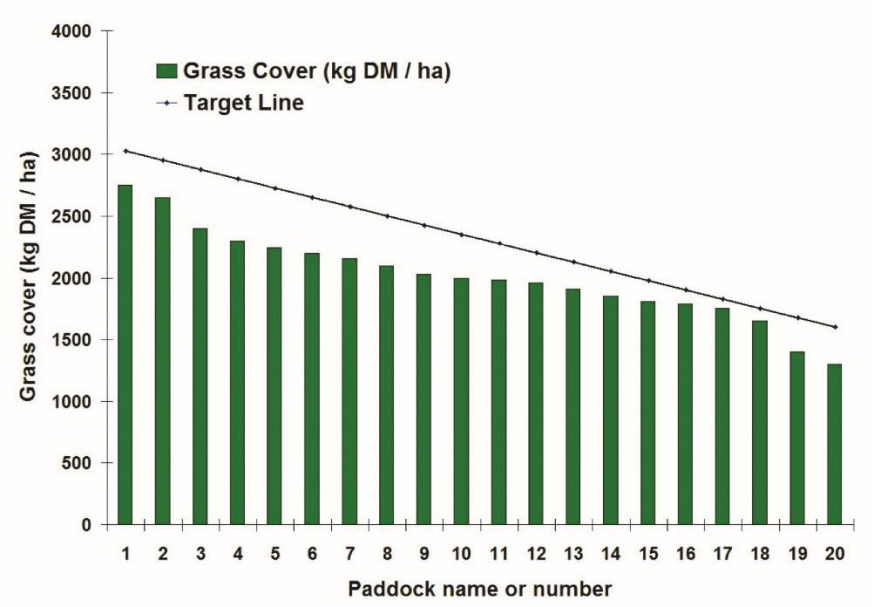


Figure 4. A grass wedge illustrating a deficit of grass across the grazing platform

In this scenario there is a serious deficit of grass on the farm. Supplementation with concentrate or silage (possibly from round bales made during a grass surplus) will ensure dietary requirements are met. The grazing area could be increased by bringing in silage aftermath or removing some stock from the grazing platform.

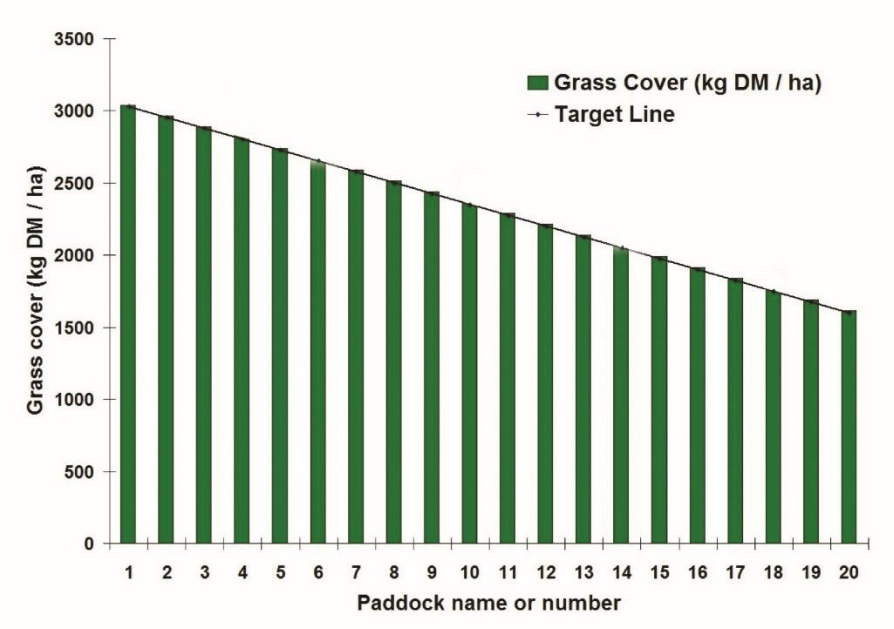


Figure 5. An ideal wedge illustrating no surplus or deficit of grass across the grazing platform

In this scenario there is no surplus or deficit of grass and no action required.
However it is important to continue to monitor grass covers regularly as changes can occur quickly due to rainfall or temperature fluctuations.

Grazing days ahead

Farmers who are experienced in grass budgeting can predict the grazing days ahead for a group of livestock by examining the grass wedge produced on their farm, determining the daily feed demand and incorporating growth information from **GrassCheck.**

Decisions can be made on whether to remove surplus grass from the grazing area based on the number of grazing days ahead of stock. For example during May, 10-12 days ahead is adequate, over 14 days will require remedial action to avoid a surplus.

Less than 10 days indicates an emerging scarcity, which requires one or more of the following options: slowing down the rotation; introducing supplementary feed; grazing some of the silage ground or reducing the stocking rate.

As growth rates decline into the autumn time the target grazing days ahead of livestock should increase (25-30 days) to ensure sufficient grass is available.
Pre-grazing covers should also increase into the autumn to allow for a reduction in the quality of grass and the time spent grazing (Table 2).

If this is not possible then some concentrate supplementation may be necessary to maintain livestock performance.

Table 2. Pre-grazing and post-grazing covers for different classes of livestock in the autumn.

Class of Livestock	Pre-grazing kg DM/ha	Post-grazing kg DM/ha	Available grass kg DM/ha
Dairy	3500	1800	1900
Beef	3500	1800	1900
Grazing lambs	2200	1700	500

Flexibility is key to any good grassland management plan, as changes are made throughout the grazing season to cater for periods of grass surplus and shortage.
This is made easier if the grazing area can integrate with the silage making area, which will provide grazing in both the early part of the season and in the back end when grass growth is slow.

Silage fields that are to be grazed early in the springtime should be closed off after being eaten down to approximately 1600 kg DM/ha. Fields allocated for silage should not be grazed after the 1st week in April to avoid making stemmy silage.

Grazing for performance – parasites at grass

Dr. Barry McInerney, DSIB, VSD Stormont

Parasites infections cost the UK cattle industry millions of pounds in production and treatment costs each year (AHDB Beef and Lamb), with most animals infected with several worm species at some point. Anthelmintics are an important part of the toolkit farmers have available to control parasites in or on their cattle. However, for decades, control has been based on interval treatment regimens involving regular administration of anthelmintics to all animals. These programmes create strong selection pressure for resistance – indeed, resistance to all classes of broad-spectrum anthelmintics and some flukicides (notably, triclabendazole) has been reported in cattle in several regions (Veterinary Times Livestock Spring Summer 2018). It is, therefore, imperative anthelmintic use is reduced, and this can be achieved by implementing control programmes that:

- use management approaches to reduce contamination in the environment
- use diagnostics to inform treatment decisions

In the cattle sector, improved uptake of these programmes is required to prolong efficacy of the existing anthelmintics as, although under study, vaccines are a long way off.

COWS
Control Of Worms Sustainably
Promoting sustainable control of cattle parasites

Control Of Worms Sustainably (COWS – www.cattleparasites.org.uk) have developed guiding principles for use of anthelmintics for dosing animals to ensure these products keep working effectively. Products should be chosen to specifically target the parasite and life cycle stage present, the time of year and previous treatment history. Even before a product is administered it is vital to ensure it is stored correctly and used before its expiry date.

Dosing equipment should be calibrated before a treatment session. Cattle should be dosed according to their individual liveweight if possible. Under-dosing can lead to increased selection of drug resistant parasites and over-dosing may require adjustments to withdrawal periods and can cause toxicities in extreme cases. From a food safety point of view, adherence to dairy and beef withdrawal periods following treatment is vital.
If there are any concerns that a treatment has not worked, farmers should talk to their vet or animal health adviser about a post-treatment efficacy check.

The main parasite threats to UK livestock are gastrointestinal or stomach worms, lungworm and liver fluke infections. Signs of disease from both gastrointestinal or stomach worms and lungworm infections are usually seen in youngstock or primarily

first season grazing animals from July onwards with reports of increasing numbers of cases each year and in some cases much earlier in the season. This is thought to be related to climate change which in some areas has allowed cattle to be turned out earlier in the season (Farmers Guardian, March 1 2019). An important difference however is that *Dictyocaulus viviparous*, the worm that causes bovine lungworm, is highly pathogenic, and compared to GI nematodes, ingestion of relatively few larvae can result in severe clinical signs, quickly resulting in substantial production losses. Its unpredictability poses a significant threat especially to young calves, potentially reducing growth rates by over 20% and costing £50 to £100 per head (AHDB Beef and Lamb). In contrast, because cattle develop little or no immunity to liver fluke, disease and/or production losses as a result of liver fluke infections are seen in cattle of all ages. COWS have developed Top 10 Tips (see links below) specific to the control of each of these diseases based on initially identifying the risk on an individual farm from each of the diseases, then implementing appropriate treatment regimes, including the use of diagnostic tests to guide treatment decisions, and finally planning ahead and avoiding the development of resistance.

Diagnostic tests can be used not only to help identify patent infections to support targeting of anthelmintics to reduce shedding of eggs/larvae, but can also be useful in investigating efficacy of anthelmintics. Faecal egg counts (FEC) tests are the most commonly used diagnostic tests available and samples can be easily taken by a farmer for submission through their veterinary surgeon to a laboratory such as AFBIs diagnostic laboratory. Faecal egg count reduction tests (FECRT) are used to investigate lack of efficacy or suspected resistance. Again this testing is available through AFBI veterinary diagnostic service. To aid accurate diagnosis good sampling technique and practice is important. It is advisable to collect samples as fresh as possible. Samples do not necessarily need to be taken directly from the animal and can be taken from dungpats on pasture, but should ideally be taken from dungpats no older than 1 hour. AFBI advises that approximately 10 g samples should be placed in a labelled airtight rigid container, and dispatched to the diagnostic laboratory ASAP (within 48 hours) with a fully completed submission form. If not possible to dispatch immediately, samples should be kept refrigerated until dispatch (4°C). Results are sent to the submitting veterinary surgeon by email usually within 24 hours of receipt in the diagnostic laboratory at AFBI.

In summary, control of parasites in grazing animals is vital to optimal performance. Control is achieved though implementation of good management practices, such as

measures to minimise risk of infective pasture, by assessing the risk of infection and together with use of diagnostic tests treat appropriately and accurately, ensuring peak performance of grazing animals while ensuring these products continue to work effectively.

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USEFUL LINKS:

www.cattleparasites.org.uk
https://www.cattleparasites.org.uk/app/uploads/2018/04/Sustainable-parasite-control-strategies-for-cattle.pdf
https://www.cattleparasites.org.uk/app/uploads/2018/04/Control-of-lungworm-in-cattle.pdf
https://www.cattleparasites.org.uk/app/uploads/2018/04/Control-of-parasitic-gastroenteritis-in-cattle.pdf
https://www.cattleparasites.org.uk/app/uploads/2018/04/Control-liver-and-rumen-fluke-in-cattle.pdf
https://www.afbini.gov.uk/articles/submission-information-vets

Supporting Profitable Sustainable Beef Production in Northern Ireland

Summary

- **AgriSearch is an independent organisation whose purpose is to help make the Northern Ireland ruminant livestock sector become more competitive, profitable and sustainable.**
- **The value of the outputs of AgriSearch to farmers is many times greater than the levy investment**
- **A wide range of resources are available on our website www.agrisearch.org**

For further information please contact Jason Rankin, AgriSearch

What is AgriSearch?

AgriSearch (The Northern Ireland Agricultural Research and Development Council) is an independent charity. It was formed in 1997 to help beef, sheep and dairy farmers become directly involved with production-oriented research and development and to ensure a continuation of government funding for such research. Our mission is to drive profitability and sustainability of the ruminant livestock sector. We do this through funding and commissioning research directly applicable on farms to farmers. AgriSearch welcomes innovative ideas and identified needs for research that may solve problems. Farmers are involved throughout our decision-making processes. We are an independent organisation (separate from AFBI) governed by a Board of Trustees (who are directors of a Company Limited by Guarantee and registered with the Charities Commission for Northern Ireland).

The value of the levy investment

Northern Ireland's dairy industry needs to continuously improve technical efficiency to remain in business. At AgriSearch, we aim to provide the current and next generation of beef farmers with the research-based knowledge they will need to build efficient, sustainable and profitable farming businesses which can help them compete in a global marketplace. To achieve this AgriSearch works with research organisations and industry bodies across Europe bringing innovation to Northern Ireland.

A review of AgriSearch co-funded research carried out in 2006 showed a 22:1 return on farmers levy, assuming adoption rates of between 5 and 10% for the various recommendations arising from the research.

AgriSearch has been heavily involved in funding a wide range of beef research activities spanning subjects such as nutrition, improved grassland utilisation, heifer rearing and use of synchronisation in sucker herds.

With levy investments of around £400,000 per year over the past 20 years we have been able to play a key role in large scale research projects co-funded by more than £48 million of contributions from industry organisations, government and international bodies. This collaboration has brought considerable benefit to Northern Ireland farmers. Much of the 'cutting edge', independent research is generated within Northern Ireland at AFBI Hillsborough and on farms of co-researchers.

In addition to the potential gains to be made from applying the findings of research conducted under Northern Ireland conditions, one direct financial payback of the data collected under the "GrassCheck" programme was that Northern Ireland was able to obtain £4.57M in 2002 for 'weather aid' payment. This source of data was also used to provide a business case for the 2013 fodder transport scheme, which brought aid of £1M to the qualifying farms in Northern Ireland. In 2018 GrassCheck weather data was used as evidence by DAERA to make a case to the European Commission for an uplift in the rate of advance payment of BPS from 50% to 70%. The 2002 aid alone is equivalent to more than 10 years of AgriSearch levy income.

It should also be noted that the on-farm BVD prevalence study which was led by AgriSearch provided the business case for Animal Health and Welfare Northern Ireland's BVD eradication scheme. Research carried out into the diagnosis of Johne's disease has also been incorporated into AHWNI's Johne's control programme.

Pioneering on-farm research

Together with researchers at AFBI, AgriSearch has pioneered the use of on-farm research. Key benefits for both farmers and scientists include:

- Much greater numbers of animals, leading to more robust data
- Range of genetics, environments and farm management systems
- First-hand farmer experience

These on-farm research projects often involve industry partners who bring knowledge and experience to the project as well as other in-kind contributions of products and services.

How is it funded?

AgriSearch is funded by means of a voluntary levy collected by dairy and red meat processors. The levy rate for beef is 40 pence per head of cattle (of which 10 pence is passed on to AHWNI to assist with the BVD eradication programme).

Who makes the decision on how the beef levy money is spent?

Research projects are recommended for funding by Sectoral Advisory Committees (Dairy, Beef and Sheep). These are composed mainly of farmers along with a processing representative and an independent scientific expert. Stewardship of AgriSearch resides with the Board of Trustees. The guiding principles behind all AgriSearch projects are that they will provide research which will be of practical benefit to farmers and provide them with tools to help reduce costs, increase performance, drive innovation and improve welfare and environmental sustainability.

Why should farmers fund research, should the government not fund it all?

Government still does fund a considerable amount of research. Understandably this tends to focus on evidence needs for guidance of policy makers. However, by the industry being willing to commit some contribution of money and by making the case for particular projects, we are able to 'lever' government funding from the available budget to commission research. In the financial year 2017/18, for every £1 committed

to research projects by AgriSearch there was a further £20 obtained from other sources.

There have been very significant changes to research funding mechanisms over the past seven years. Across all funding streams there is a requirement for active industry involvement and leadership. Collaborative projects are becoming more common and this trend is likely to continue.

In circumstances where AgriSearch's levy income on its own will not go far in payment for research, the real value of AgriSearch is the industry engagement it can bring and represent in a project, particularly the ability and experience in facilitating on-farm research.

Conclusion

AgriSearch's primary focus is to provide a return to Northern Ireland's dairy, beef and sheep farmers for the levy investment they put in. Reviews have estimated that return to be between 20 to 1 and 40 to 1 (based on 5 to 10% adoption rates).

AgriSearch provides farmers with the latest research and knowledge to help them improve technical efficiency.

AgriSearch provides a means for farmers to have a voice and role in research projects, the findings of many of which will inform government policy in the future as well as providing farmers with the tools and information needed to compete in an ever-changing world.

Get the most out of your levy by engaging with AgriSearch, bring forward questions / research needs and use the information available on the website www.agrisearch.org and following our social media channels.

Current Beef Research Projects

Strategic Antimicrobial Use in Dairy, Beef and Lamb Production (STAMP)

Research Partner: AFBI
Industrial Partners: LMC, AHWNI, Farm Vet Systems
Funding: DAERA Research Challenge Fund & AgriSearch

This ambitious new project aims to develop a farm level benchmarking system for antimicrobial usage on dairy, beef and sheep farmers in Northern Ireland. In addition, through work at AFBI, Hillsborough and on-farm (through veterinary practices) decision support tools will be developed in the fields of selective dry-cow therapy and neo-natal calf management. A stakeholder forum has been established to help guide the project. The other partners in the project are: AFBI, Animal Health and Welfare Northern Ireland, Livestock and Meat Commission for Northern Ireland and Farm Vet Systems.

Food Futures: Smart Sustainability Tool

Research Partners: Queen's University & AFBI
Industry Partners: Multiple (including all major NI dairy and red meat processors)
Funding: Agri-Food Quest Competence Centre, AgriSearch and other industry partners

The Flagship Food Futures project adopts a unique participatory approach to evidence and enhance the sustainability credentials of Northern Ireland Agri-Food. The objective is to develop a holistic Sustainability Platform including reporting tool for agri-food supply chains. Robust, industry wide, evidence-based tools will generate reports for use by the industry, consumers and any future Northern Ireland Marketing Body.

Under the pillars of Economic, Environmental and Social and Ethical sustainability, simple, user friendly, scientifically robust metrics will be developed. These complex metrics will be prioritized and consolidated into a single indicator of sustainability. The integration of existing data flows with Northern Ireland Agri-Food industry and new novel world leading outcomes of sustainability related projects will feed into the development of the toolkit.

The project is jointly led by Queen's and AFBI and has 12 other industry partners.

Evaluation of ammonia emissions from livestock enterprises

Research Providers: AFBI & Rothamstead
Funding: DAERA Evidence & Innovation Strategy, AgriSearch & other industry contributions

The aim of this project is to increase the scientific robustness of ammonia emission factors and investigate mitigation strategies to reduce ammonia emissions for the livestock sectors in Northern Ireland. While in measuring ammonia emissions from manure management of livestock production, we will also measure effects of different feeding and management factors on greenhouse gases (CO_2, CH_4 and N_2O) emissions from manure storage. Such information is important for providing the baseline environmental footprint associated with livestock production in Northern Ireland.

SUPER-G: Developing sustainable permanent grassland systems and policies

Funding: European Union Horizon 2020 Programme

This major Horizon 2020 project involves 20 partners from 14 countries and will have a total budget of €10M over 5 years. Between AgriSearch and AFBI almost €1M is being spent in Northern Ireland. The main objective is to develop integrated approaches for permanent grassland management that are cost-effective, environmentally sound and easily manageable. The project will:

- Define systems
- Benchmark
- Provide decision-support tools for farmers, advisors and policy makers.
- Influence policy

Beef from Grass: An evaluation of beef grazing systems and trace element supplementation within suckler beef production

Research Provider: AFBI
Funding: DAERA Evidence & Innovation Strategy & AgriSearch

The objective of this project proposal is to improve grazed grass utilisation in Northern Ireland beef production systems. The project involves 4 work packages:

1. Beef grassland survey
2. Quantification of beef production from grass across Northern Ireland (GrassCheck)
3. Development of a blueprint for increasing grass production beyond 12 t DM/ha on a beef farm with maximum utilisation
4. Evaluation of trace element supplementation on animal performance

An evaluation of rumen temperature as proxy for the indication of key stages in the lifecycle of breeding beef animals

Research Provider: AFBI
Funding: Centre for Innovation Excellence in Livestock (provision of boluses) & AgriSearch

The overall objective of this study is to establish if rumen temperature can be used as a proxy for the key stages in the lifecycle of breeding beef cattle.

CIEL have funded 200 rumen temperature boluses for use within the AFBI suckler herd over the next 5 years. AFBI have also procured a number of precision technologies (pedometers, calving detectors, heat detectors etc.) The outputs of these precision technologies will be aligned with rumen temperature to establish whether temperature could be used as a proxy for either ill health or detection of key occasions during the life cycle of a suckler cow (e.g. oestrus, weaning, calving etc.).

Feed into Beef Nutrition (Industry Group Membership)

Redefining nutrition standards for improving beef production efficiency

Research Providers: AFBI & SRUC
Funding: AHDB, AgriSearch and other industry group partners

The project aims to update and enhance nutrition guidelines for the UK beef industry. This will involve revision of existing modules, adding in new modules and verifying internal consistency of these models. Feed tables will be updated to fit with these new models.

The UK feed trade currently rely on 3 main nutritional models to provide nutritional guidance for approximately 1,500 advisors to predict livestock intake and performance. Such models are based on equations developed 30 plus years ago and there is now ample evidence to indicate that these underestimate the nutrient requirements of beef cattle, thus reducing their efficiency and profitability. The project will address this issue by undertaking a detailed review of the scientific literature on beef cattle nutrition over the last 30 years. A number of production studies will be undertaken at AFBI Hillsborough to produce data to fill these knowledge gaps, particularly in the area of grazing systems. On-farm monitoring of feedstuff and animal performance will be used to validate the newly developed prediction equations.

Development of systems to improve dairy origin beef young stock health and performance

Research Providers: AFBI & Queen's University
Funding: DAERA PhD Studentship and AgriSearch

Dairy-origin beef production is a key component of the UK beef industry accounting for 57% of the total prime beef supply. However, only 51% of the total UK prime beef actually meets target market specification. This is predominantly due to cattle not meeting the target age, weight and/or conformation requirements at slaughter. Optimising health and performance throughout the production system is vital to maximise profitability and ensure market specification is met.

This project will investigate systems to improve the health and performance of dairy-origin young stock by researching 5 key areas:

1. The effect of calf jackets on health and performance during the rearing period
2. The effect of Holstein bull beef production system on health, performance, carcass characteristics, meat quality and economics of production.
3. The use of rumen temperature boluses for the early detection and treatment of disease in youngstock
4. The effect of behaviour (particularly aggression) on rumen temperature in young bulls
5. The use of rumen temperature as a novel welfare indicator during the pre-slaughter phase and subsequent indicator of meat quality

BovIS Mart Data Project

Research Provider: AFBI
Funding: DAERA Evidence and Innovation Strategy, LMC & AgriSearch

Based on integrating information collected in the cattle supply chain, this proposed project will provide

1. Real-time online management applications available for all cattle producers in Northern Ireland to inform management decisions and
2. New genetic evaluations based on industry-wide data to underpin the sustainability of the industry.

This project measures phenotypic expression for a range of complex traits key to resource use efficiency in the industry and provides the basis on which genomic evaluations can be developed and their success measured.

The proposed project builds on the core integrated cattle phenotypic database which has been developed in Northern Ireland – the Bovine Information System (BovIS). This database contains statutory information from DARD's Animal Health and Public Information System (APHIS) (births, deaths, date of movements, breed etc) and information from meat processor plants in relation to carcass weight and quality

uploaded on a daily basis. The new proposal widens out the scope of the database through capturing the live weight, growth rate and animal quality information of cattle, sold through Northern Ireland livestock markets. This additional information will be stored within BovIS and also be distributed to an LMC database.

Improving the control of liver fluke in cattle in the United Kingdom

Research Provider: Liverpool University, Moredun Research Institute, SRUC & CEH
Co-funding: Biotechnology and Biological Sciences Research Council (BBSRC), AHDB, QMS, HCC and AgriSearch

The aim is to improve control of F. hepatica infection in cattle by developing new management tools. This is a focused, integrated project combining cutting-edge mathematical and economic models, informed by data collected from the field culminating in farm level intervention programmes to fully evaluate the theoretical outputs from the models.
The project is divided into five inter-linked work packages:

1. Development and validation of herd level diagnostic tests to identify farms with fluke infection and to discriminate between fasciola and paramphistome infection.
2. Field level classification of snail habitats, and identification of factors that influence contacts between cows, snails and the parasites.
3. Identification of farm risk factors for F. hepatica infection in dairy and beef enterprises and development of statistical and mathematical models to predict the likely benefits of implementing changes to farm practice of fluke prevalence.
4. An economic analysis to define costs of fluke infection at herd and national level
5. An evaluation of an on-farm intervention programme aimed at reducing prevalence of fluke infection on dairy and beef farms

Rumen fluke in cattle and sheep: measuring impacts and improving diagnosis

Research Provider: Queen's University & AFBI
Funding: Biotechnology and Biological Sciences Research Council (BBSRC), AHDB and AgriSearch

The specific aims are to determine:

1. What is the extent of the rumen fluke problem in the UK?
2. What is the impact of rumen fluke on animal performance, health & welfare?
3. Can we develop a rapid and specific diagnostic test for rumen fluke?