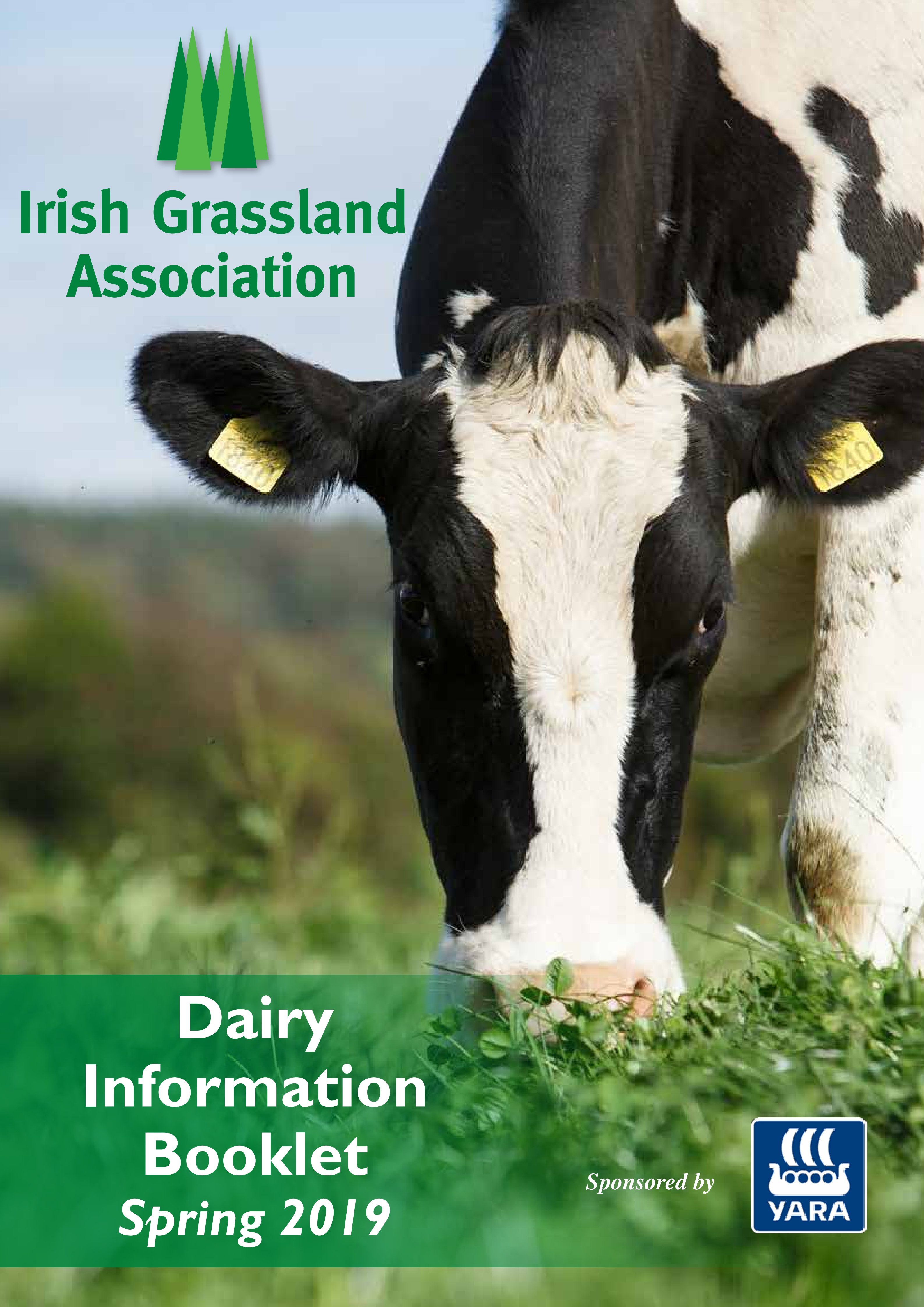


Irish Grassland Association

Dairy Information Booklet

Spring 2019

Sponsored by

YARA

CORPORATE MEMBERS 2019

Want to have your company logo on this page?
Contact the Irish Grassland Association office today...

CORPORATE MEMBERS 2019

Cookstown, Kells, Co. Meath, Ireland. Tel: (087) 96 26 483
General Information: secretary@irishgrassland.com www.irishgrassland.com

Table of Contents

Irish Grassland Association

Operating a high profit dairy farm with medium levels of input

Rhys James, James Bros Duckspool Farm, Wiston, Haverfordwest, Pembrookshire, Wales

Background

At James Bros Duckspool we farm 444 acres (180 ha), of which, 300 acres (121 ha) is at Duckspool, with a support block of 115 acres (47 ha) three miles away and another 27 ac (10.9 ha) in Wiston. We are a typical grass based spring block calving dairy system maximising the use of grazed grass to control costs to run a simple profitable and enjoyable farming system.

All land is down to long term leys and have all been re seeded in the last six years to a late heading tetraploid/diploid and clover mixture from Bahrenburg seeds. Weeds are controlled by a combination of a weed wiper, spot sprayer and a boom sprayer to help achieve clean swards to grow high quality pasture.

The herd is paddock grazed around 32 paddocks, all paddocks have tracks leading to them and concrete water troughs supplied by the farms borehole. We measure grass weekly with a quad bike mounted electric reader, this information gets entered onto Agrinet, our grass software to create the grass wedge, with this data we can decide which paddocks to silage or round bale during peak growth periods in order to remove the surplus to ensure the highest quality grass is available for grazing, we can also decide when to bring in extra dry matter in the form of silage or concentrates if the grass wedge shows a deficit as highlighted by the Agrinet grass management software.

Dairy enterprise

Currently the land supports 430 head of NZ Friesian x Jersey cows milked twice a day. The herd will average 5,500 litres, 470kg milk solids from typically 1,000kgs concentrates fed through the parlour feeders flat rate. The 95 ha grazing platform is stocked at 4.1 cows/ha. The farm produces 14159 litres/ha overall and 19893 litres/ha from the milking platform with a total of 2.4 m litres sold to Glanbia cheese.

Last year's Comparable Farm Profit (CFP) which I have attached showed total expenses at 17.5 ppl, with a CFP of 7 ppl before depreciation and unpaid labour, with a low milk price last year of only 19.2 ppl. I have also attached a copy of the CFP year ending in 2015 showing a healthier milk price of nearly 24ppl, expenses of 19ppl and a CFP before depreciation and unpaid labour of 10ppl. Therefore, we have a robust and sustainable system that can weather the storm of volatile milk prices. We benchmark our financial data in our discussion group annually and have monthly on farm meetings to discuss relevant on farm topics and share knowledge.

The herd is block calved on a grass based system from early February until mid-April. Cows graze by day in February and are usually turned out by night in March as weather allows and grass covers are sufficient for the extra demand on the grazing platform of night grazing. The herd is milked through a modern *Milfos* 28/56 swingover herringbone with cluster removers and an automated plant washer. Milk recording is carried out quarterly to identify high somatic cell count cows and Johnes positive animals. Cows tested positive are given red tags, inseminated to beef semen and calved separately to the rest of the herd.

All cows are housed over the winter in a simple open sided cubicle shed with mattresses' and bedded on sawdust. Cows can express natural behaviour to chose their evironment when housed as the feeding yard is situated outside the shed. Building this shed allowed us to carry more cows on the farm and increasing the stocking rate from 3 to 4 cows/ha by housing the cows by night in early spring, (Feb) and late autumn, (November). The building has been a huge asset to the farm and has enabled more days in milk in the autumn. In very wet weather we can now house cows to limit poaching and soil erosion.

We employ two local staff at Duckspool and a relief milker. They are all excellent at their roles and work well as part of a team which is crucial for running an efficient dairy farm. The herds manager has the responsibility of herd health, calf rearing and assisting with measuring grass and using the Agrinet grass management software, whilst the stockman/tractor driver carries out all other stock duties as well as field work including fertiliser spreading, mowing silage, tedding and slurry work as well as farm maintenance and fencing. To save energy we installed a 50 KW solar array on top of the cubicle shed roof, this can be seen in the photo above, it has halved our annual electric bill and we receive the (FIT). We also installed heat recovery units on the milk bulk tank, pre warming the hot water heater for the plants hot wash.

Replacement heifers

We rear 140 head of dairy heifers per year, these are kept from AI'd cows from the first three weeks of calving and from all the first calving heifers. These graze a 25-ac block at Duckspool that isn't accessible to the cows and some other off lying land. We weigh the calves with a True-Test electronic scales each month to make sure they are on track with growth rates, this determines when concentrates are cut out. Any calves with lower liveweight gains are grouped separately and are kept fully fed by luxury grazing. The second year group of heifers graze the support land three miles away, these are synchronised for AI typically on the second of May with NZ Friesian bulls. The heifers are also paddock grazed for maximum daily live weight gains.

Grass silage is carried out by a contractor; we do our own mowing and tedding. We share our machinery between farms as much as possible to minimise our power and machinery costs. We usually look to do around 500 acres in total and aim to clamp 3,000 to 4,000 tonnes. Surry in applied via a dribble bar and umbilical system by a contractor on the grazing paddocks and is also applied onto the silage ground by our own slurry tanker. We have our own GPS linked variable rate fertiliser spreader, we use this to apply fertiliser onto our grazing land every 3-4 weeks and silage area accordingly. The GPS link allows more accurate spreading and the shutters open and close automatically on the headlands and the border spreading kit means that fertiliser isn't thrown into the hedgerows. This improves hedgerow habitat and reduces fertiliser usage.

Environmental issues

With NVZ's looming, we have recently constructed a 3 million gallon slurry lagoon, capable of storing 6 months slurry storage allowing us to spread slurry on silage and grazing ground when the time is right and weather conditions allow. The nutrients can be best utilised, this has improved our slurry management and use of nitrogen and also controlled the risk of pollution to watercourses. I believe that by spreading slurry at the correct times and correct ground conditions has allowed us to grow more grass and has reduced soil compaction and enabled better soil health on the medium loam soils. Clean yard water and roof water is diverted and kept out of the slurry store.

Rainfall at Duckspool is typically 50 inches /annum (1,270mm) and mainly south facing with a gentle slope on a quarter of the land. Grass growth throughout the summer is good, last year the farm grew 15t DM/ha, this was recorded on our Agrinet software. This was from annual fertiliser usage of 250 kg N/ha on the milking platform. We soil sample the farm every two years and apply P and K and lime accordingly. Soil fertility has also improved due to the increased stocking rate. We are fortunate that the farm doesn't usually burn during summer.

We look after the environment by taking pride in our hedgerows, and alternate some hedge trimming to trim every other year on the support block to help wildlife. All hedgerows and woodland is fenced with either electric fencing or by netting and barb wire. The stream that runs through the farm has been fenced off and all livestock now drink from water tanks situated in each paddock. We have a good relationship with the Pembrokeshire Council, allowing an old bridal way that runs through the middle of the farm to be re opened and cleared in 2015.

Key characteristics of highly profitable dairy farms

Mike Brady,
Brady Group, Agricultural Consultants & Land Agents, The Lodge, Lee Road, Cork. T23 KW88

Introduction

It is now over ten years since the announcement of the removal of EU milk quotas in 2007. The 31st of March 2015 is often referenced as the end of the EU milk quota regime, but the reality is highly profitable Irish dairy farmers were planning for 'the no milk quota world' immediately after the 2007 announcement.

The first noticeable change after 2007 was a significant reduction in the number of dairy farmers exiting the industry. This reduced opportunities for ambitious dairy farmers to rent additional land, but instead they expanded their dairy businesses within the farm gate by exiting beef and tillage enterprises and increasing dairy cow numbers (table 1). This was facilitated by the EU providing increases in milk quotas for all producers.

Table 1. Dairy Cow Numbers 1978 – 2017.

	1978	1988	1998	2008	2017
Dairy Cow Numbers (million)	1.51	1.33	1.20	1.02	1.34

Source: CSO

Then next stage in the development of highly profitable dairy farmers was developing expansion plans and availing of the new capital building grants in 2007/08. These grants helped provide farm building infrastructure for livestock accommodation, milking facilities and pollution control.

Some expansion plans were delayed due to the return of super-levy as milk production caught up with and exceeded the increased milk quotas. The Irish Government put in place a plan to expand milk production by 50% from 2011 to 2020. This plan will be achieved at the end of 2018 two years early.

So how has this expansion affected and influenced Irish dairy farmers? This paper examines the characteristics of highly profitable dairy farmers in this era.

What is a highly profitable dairy farmer?

There are many financial indicators which measure farm business profitability. Net Profit per hectare of all land farmed is emerging as the Key Performance Indicator (KPI) to benchmark financial performance on Irish dairy farms. Teagasc Moorepark have a stated target for Net Profit of €2,500 per hectare for all land farmed for Irish dairy farmers.

However, the other side of the profitability equation are the number of hectares owned and farmed. The average dairy farmer owns approximately 37 hectares therefore the potential Whole Farm Net Profit is €92,500 using the Teagasc target (37 ha x €2,500 per ha= €92,500).

Highly profitable dairy farmers = High € Net Profit per ha X High no of hectares farmed

1. Own a lot of land

The first characteristic of highly profitable dairy farmers is the amount of land they own. Unfortunately, very often the amount of land owned by a dairy farmer is not a reflection of the financial or technical performance of their business but that of previous generations of their family.

The simple equation is, more hectares owned equals higher profits (see Table 2). Of course, this land must be in the grazing platform for Irish grass based dairy farm systems.

Table 2. Net Profit for different farm sizes achieving Teagasc target of €2,500 per hectare.

Land area (ha)	40 ha	120 ha	200 ha	400 ha
Cow Number (no)	100	300	500	1,000
Net Profit (€)	€ 100,000	€ 300,000	€ 500,000	€ 1million

In Table 3 two dairy farmers are compared: Dairy Farmer A owns 40ha but rents an additional 80 ha; Dairy Farmer B owns all 120 ha farmed. Both farm 120ha, milk 300 cows and make €248,000 Net Profit each on the whole farm.

Dairy Farmer A can make a Net Profit of €2,500 per ha (before land rent) and Dairy Farmer B makes €2,067 per ha, a full €433 per ha less. Now both are highly profitable dairy farmers but Farm A clearly has better technical and financial performance. Therefore, when assessing the characteristics of highly profitable dairy farmers consideration must be given to the amount of land owned, size matters.

Table 3. Comparing Net Profit and financial performance for two dairy farmers.

	Dairy Farmer A	Dairy Farmer B	Difference
Land owned (ha)	40	120	
Land rented (ha)	80	Nil	
Land farmed (ha)	**120**	**120**	**0**
Cow Numbers (no.)	**300**	**300**	**0**
Net Profit per ha before land rent (€)	€ 2,500	€ 2,067	-€433
Land Rent at €650 /ha for 80 ha (€)	€ 433	0	
Net Profit per ha farmed (€)	**€ 2,067**	**€ 2,067**	**0**
Net Profit (whole farm)	**€248,000**	**€248,000**	**0**

2. Know their system of milk production

Systems of milk production in Ireland can be broken into four general categories Over 90% of producers in the Republic of Ireland are spring calving milk producers i.e. system 1 or 2 in Table 4 below.

Table 4. Systems of milk production in Ireland today.

1	Low input spring production
2	High input spring production
3	Winter / liquid autumn & spring calving
4	Confinement dairying

Teagasc eProfit Monitor benchmarks the financial performance of spring producers versus winter/liquid producers. Table 5 below compares 7 years of data and the average difference between the systems is only €66 per ha per annum in favour of winter producers

Table 5. Teagasc eProfit Monitor Spring milk -v- Winter Milk producers (Net Profit € per ha).

	2017	**2016**	**2015**	**2014**	**2013**	**2012**	**2011**	**Av**
Spring milk	2,168	1,090	1,428	1,806	1,635	1,211	1,599	**1,562**
Winter milk	2,198	1,266	1,400	1,928	1,660	1,246	1,700	**1,628**

Highly profitable dairy farmers know and understand the system of milk production they practice on their farm business. They stick with it and practice it to the best of their ability given the constraints of their holding. There is a wider range of financial performance within systems of milk production than between them.

3. Good financial literacy – understanding of risk and bank finance

Highly profitable dairy farmers understand the combination of risk and bank finance. A dairy farmer with a plan to grow and increase whole farm Net Profit will need to borrow money to invest in livestock, buildings, machinery and land.

When planning a project firstly, they thoroughly examine the various options available to them. Then they choose one option, prepare a business plan, carry out a stress test/contingency plan, apply and obtain finance and then execute the plan.

A dairy farmer intimately familiar with the finances of the farm business will identify opportunities and weaknesses earlier, this will ensure a better relationship with their bank while giving the farm business a definite edge on competitors when making important decisions.

Highly profitable dairy farmers understand farm business finances.

4. Leadership skills - can manage labour well

The successful dairy farmer of the future must have excellent leadership skills. With average herd size approaching 100 cows, employed labour will be required on many farms. There is presently a major gap in the skill level of Irish dairy farmers in management of employed labour.

Highly profitable dairy farmers are good leaders and can manage labour well.

5. Good technical ability

Technical efficiency is critical to excellent physical and financial performance of a dairy farm business. However, Irish farmers have a habit of over emphasis on fashionable technical efficiency factors to the detriment of financial and other important factors e.g. yield per cow.

Highly profitable dairy farmers identify and prioritise the technical efficiency factors that drive the profitability of their system of production i.e. tonnes of grass utilised per ha farmed.

6. They have a good team around them

It is vital to have a trusted sounding board for decision making on major projects and the day to day running of a dairy farm business. Every business owner needs a core team of trusted advisors/mentors. The team should consist of a dairy advisor/consultant, tax advisor, legal advisor, banker and possibly a person outside of farming. Dairy farmers should draw on the excellent research done by Teagasc Moorpark via membership of a relevant discussion group and fine tune with one to one contact with the advisor/consultant.

Highly profitable dairy farmers have a longstanding trusted team around them.

7. They have balanced personal values

Dairy farmers are full of ambition and pride, this is the fuel that drives them to grow and improve their dairy businesses. Some fail to control this ambition and pride to the detriment of family life, their health and ultimately the success of their business.

Highly profitable dairy farmers are very ambitious and full of pride, but they have a good work life balance which ultimately contributes to the success of their businesses.

Conclusion

The grass based systems of milk production in Ireland are conducive to producing highly profitable dairy farmers and farm businesses. The combination of high Net Profit per hectare and owning a lot of hectares will produce dairy farmers with multiple units in future years. This will mean fewer dairy farmers but more dairy cows unless environmental legislation halts the progress.

Operating a high profit dairy farm with low levels of input

Denis & Collette O'Donovan, Rosscarbery, Co. Cork

Introduction

I come from Rouryhill farm on the Wild Atlantic Way, between Rosscarbery and Glandore in West Cork. I am married to Collette and we have one son Eoghan. We both work full time on the farm.

Background

I completed my Certificate in Farming at Teagasc Darrara Agricultural College in Clonakilty in 1990. I then worked on local farms gaining experience until 1996. At that stage I came home farming fulltime from my parents DJ and Sheila. I did the Dairy Diploma course through Darrara College in 1997 and was lucky enough to be selected as a Monitor Farmer in the first Carbery/Teagasc Joint farm development programme co-ordinated by John McNamara Teagasc. Somewhere along the way I managed to get time to get married in 2000 to Collette (who is still with me today!!). In 2012 I formed a milk production partnership with a neighbour and bought 7.5 ha of land (now part of the milking platform). Today we farm 66 ha of which 44 ha comprises the milking platform (see Table 1).

Table 1. Physical performance in 2005, 2010, 2013 and 2017 on the O'Donovan farm.

	2005	2010	2013	2017
Physical				
Land owned (ha)	17.8	17.6	21.0	21.0
Land leased (ha)	36.4	32.0	34.4	45.1
Total area farmed (ha)	54.2	49.6	55.4	66.1
Milking platform	25.5	25.5	40.0	44.0
Livestock				
Dairy cows	75.8	103.5	131.5	150.0
Replacement LU	20.6	41.4	45.7	40.9
Cattle LU	40.7	3.3	9.0	6.8
Milk production				
Milk sales (000 litres)	398,146	470,301	556,943	728,967
Milk solids (kg/cow)	420	370	378	437
Fat (%)	3.86	4.23	4.60	4.84
Protein (%)	3.39	3.43	3.63	3.88
Grass production				
Grass used (T DM/ha)	10.9	10.2	9.2	11.9

Labour

Myself and Collette work fulltime on the farm. My father is very active and helps out whenever extra help is needed. I realise he is doing untold unseen work around the farm that is saving me countless hours. Collette and our son Eoghan are in charge of the calf rearing each spring. Our farm has gone from doing everything ourselves: slurry, silage, reseeding, baling, to employing a contractor for everything except fertiliser spreading on the milking platform which we still do ourselves. A contractor spreads the fertiliser on the outside heifer rearing and silage production block.

Influences

I am a member of two discussion groups and give them great credit. They are both well run and profit focussed groups where there is plenty of constructive criticism given and taken (sometimes maybe too much!). Through being a monitor farmer and a member of profit-focused discussed discussion groups, I've made making profit my focus. The benefit of comparing costs and profits with other farmers in the group helped me get an attitude of "if they can do it so can I! I learned early on that the way to produce high profits was to focus on "Grass, Grass, Grass". When quotas were in place we fattened cattle. Since quota removal we've specialised totally in dairying. I like a quote that I attribute to Matt Ryan "*Put all your eggs in the one basket and put both hands under the basket*". That is what we have done at this stage.

I went to New Zealand in 2007 on a farming tour organised by Abigail Ryan and John McNamara. While the highlight of my trip there may have been the white water rafting we did, I did bring home with me some key messages:

- Cross bred cows had high fertility and you could calve half the herd in 2 weeks;
- Fertility drives the system as with it you can match your calving to your grass supply;
- Crossbred cows are very efficient at converting grass into milk solids and the best are capable of producing their own liveweight in kilos of milk solids per lactation.
- Lincoln University dairy farm showed me that going into lower pre grazing covers allowed low post grazing residuals (golf ball grazing). I had never played golf until then!
- New Zealand farmers we visited were all profit driven, "production is for vanity, profit is for sanity";
- Money Breeding Grass were the key drivers of the Carbery Monitor farms and that was what I saw reinforced in New Zealand

I wrote down the messages from New Zealand when I returned from the trip (mainly because my discussion group (The Greenfield Group) was in the Discussion Group EBI Competition that year, and we were preparing for the judges visit (we won the Competition that first year by the way!).

2008

We changed the milking parlour in 2008 and installed a new 20 unit Dairymaster parlour with automatic cluster removers (ACRs), and a new 10,000 litre bulk tank. We also built a 90m x 20m wood chip out-wintering pad with a concrete feed and cow passage with an 800,000 gallon slurry lagoon, we claimed grants on all this work. We since converted this to outdoor cubicles in 2017, this now provides us with wintering accommodation for 200 cows.

Out-wintering Stock

Prior to this we were out-wintering most of the dairy stock. The in-calf heifers used to be wintered on Westerwolds and baled silage fed in the field. This was usually on ground that we had rented for whole crop wheat. After harvesting the whole crop we used to set Westerwolds each year. We also out-wintered stock on swedes and fodder beet. The summary of all this out-wintering is that yes its low cost, and you do it while one is building up a herd and the farm. The cows did ok on out wintering but I found it harder work each year. It was hard work but it had to be done. Leasing milk quota brought land with it and the whole crop was a way of using this land and when we were tight on housing the out-wintering served a purpose.

Breeding

The trip to New Zealand in 2007 was the final convincing I needed to go crossbreeding with Jersey AI. We now have a fully crossbred herd. It is high EBI – herd average €155. Eighty eight per cent calved in 6 weeks in 2018 with 13% first calvers. Six per cent were not in calf after a breeding season lasting 10 weeks and 2 days in 2018. We are using NZ Friesian sires on the more Jersey cows, Jersey sires on the Friesian type cows, and some KiwiCross sires on the crossbred cows that I am happy with size-wise.

We have found that having cows in the right body condition score at breeding and on a rising plane of nutrition sets the herd up for high conception rates. I AI cows myself twice a day and feel that this is adding a little to my high conception rates and low infertility. We are obsessive about tail paint and keeping it topped up ... It's not just lip service. After three weeks AI and manual observation we run vasectomised bulls with the herd to help detect cows in heat. We run one home grown crossbred bull (ROURYCROSS!!) per 50 cows in the herd, alternate them, and have subs available in case any player goes down injured.

The breeding heifers are three miles away. They never graze on the milking platform. They leave the home farm after Collette has reared then for five weeks and move to this outside block. They run on a leader follower grazing system on this block. They are wintered in a slatted shed for their first winter and go to grass early to be ready and on target weights for the breeding season. We carry surplus heifer calves to utilise this outside rented land and we sell about 40% of the total number of heifers we keep each year as in calf heifers coming into the autumn. They are not making a big margin but they are using this land block which we need for our own heifers and to provide silage for the dairy herd.

Grass

I suppose I am a grass farmer more than a dairy farmer. Our objective is to grow as much grass as we can. We have a motto "*we won't give the paddock any excuse not to grow*". This means regular soil testing to make sure we keep the lime, P and K status of the ground right. We use the umbilical system for spreading slurry from the lagoon on the grazing block. After growing this grass we try to utilise as much of it as possible by going into the right covers and grazing down to low residuals every time. If we need to, we cut any paddock that gets over 1,700 kg DM/ha. We run a high stocking rate on the grazing block of 4.5 cows/ha in the peak growth months of May and June. Estimates of grass dry matter used per hectare are detailed in Table 1.

High stocking high Inputs vs. medium stocking low inputs

We have been down the road of a high stocking rate on the milking platform. We drifted into this system rather than make a conscious decision to go that route (see Figure 1).

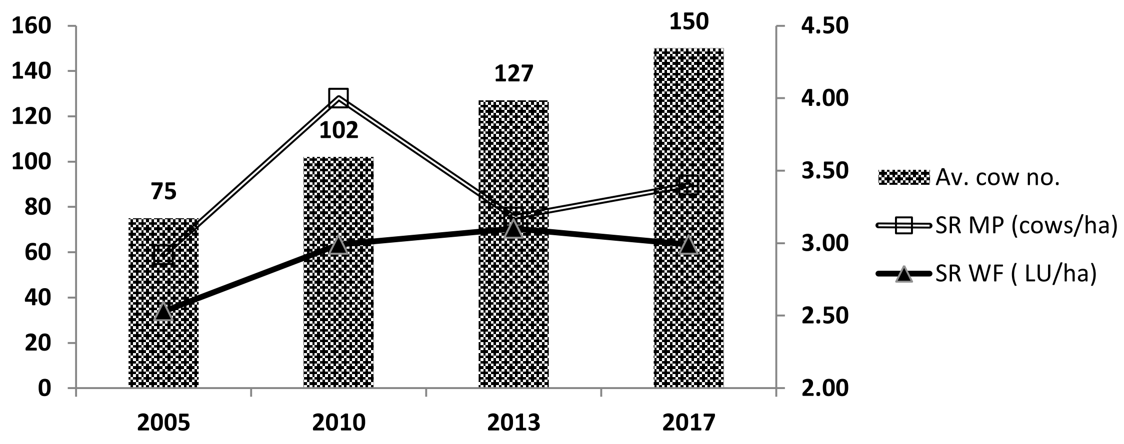


Figure 1. Average herd size, milking platform stocking rate (cows/ha) and whole farm stocking rate (LU/ha) on the O'Donovan farm in various years between 2005 and 2017.

We were renting quota and the land that had to come with it back the years. We could only produce this milk off the grazing land we had available, so we grew whole crop wheat on this rented land and fed this in the shoulders of the year because our stocking rate was too high to feed the herd on just grass and ration in those months. At the time I was happy I was making money doing this. My Profit Monitors at the time compared to my group colleagues looked good too. However when we hit low milk price years (like 2013) I took a bigger hit in profit that them (see Table 2). I was also working a lot harder and longer hours than them for little extra reward in even the high milk price years. Another negative is the added stress on man and animal when you get a bad weather year at excessively high stocking rates. I have been lucky to have increased my grazing platform by both land purchase and land rental and I will not increase my stocking rate again to the level where I have to feed other than grass and ration in the shoulders.

Table 2. Financial performance in 2005, 2010, 2013 and 2017 on the O'Donovan farm.

	2005	2010	2013	2017
Actual financials[1]				
Co-op price (c/litre)	28.3	32.8	45.8	42.8
Gross output (€/ha)	2,797	3,923	3,243	5,612
Variable costs (€/ha)	768	1,404	1,160	1,714
Fixed costs (€/ha)	934	1,009	834	1,275
Net profit (€/ha)	1,095	1,511	1,249	2,623
Adjusted financials				
Co-op price (c/litre)	31.5	33.1	35.7	38.2
Net profit (€/ha)[2]	**922**	**1,310**	**1,083**	**2,990**

I agree with Brendan Horan's research that there is no margin in driving the stocking rate above what the farm is capable of growing, plus 500 kg of meal fed strategically, mostly in Spring and Autumn. This has been my personal experience too.

I now have a simple grass based system that takes less labour and is less stressful on man and animal. We are marketing our products (and gaining a niche and premium for them) on the basis of the milk being produced from cows on a grass fed system. Other countries are now paying milk bonuses to encourage their suppliers to get the cows out of the houses grazing grass for more hours and more days in the year. We have what the consumer is currently looking for, why would we go against this and start moving cows in earlier and for longer?

[1] Based on whole farm area, gross output, costs and profitability per hectare.
[2] Based on whole farm area with net profit adjusted to a constant base price of 30 c/litre with adjustments of €3.58/kg and €6.08/kg for higher fat and protein content respectively; own labour costs of €60,000 included to account for family labour.

The Future

I think the market is telling us very clearly the future will be all about sustainability including water quality and quantity. Access to water to grow animal feed is going to be our biggest competitive advantage. Carbery farmers are using 7 litres of water (cow drinking water, wash down, etc.) to produce a litre of milk, Catalonia farmers are using 44 litres to produce the same litre! Carbery farmers have a carbon footprint of using 1.04 kg of CO^2 to produce a litre of milk whereas that figure is 1. 5kg for U.S. milk production (same composition milk). We will all be growing trees on part of our farms in future for the environment. We need to protect our "social licence" to farm. We can see that NZ dairying has done serious damage to theirs even within their own country. No one has a lot of sympathy for corporate farming operations. We need to value and protect the family farming model we still have in Ireland. I keep a close eye on the excellent research being done in Clonakilty College on using clover in the swards. If they can match the gain in milk solids per cow and per hectare that the clover swards are delivering with reduced nitrogen inputs, then this will improve output and reduce costs.

West Cork Farm Tours

A group of us came together to form this two years ago. The idea sprang from "The West Cork Farming Awards" and our local hotel (Celtic Ross) asking was there anywhere they could send tourists who wanted to visit a local farm. We are on the Wild Atlantic Way and saw that there was an opportunity to show off what we are doing to interested tourists and maybe make a few bob or create a job for one of our kids along the way. There are four farmers in the group and during the tourist season we take a group of visitors one day a week. We show them around the farm and give them a taste of West Cork hospitality when we finish up. They pay a small fee for the tour. They are amazed to see happy cows out grazing grass. Some of the cows are now looking to get an agent to manage their social media as the amount of photos of them that have been Tweeted, Instagrammed, Facebooked is getting out of hand and they are getting no benefit!

Marginal profit from marginal milk

John Roche, Managing Director, Down to Earth Advice Ltd.

Summary

- Although pasture utilisation is very important to profit, a high pasture utilisation doesn't guarantee high profit;
- Although a low cost of production is an important determinant of operating profit, you can have a low cost of production, but be producing unprofitable milk;
- Using supplements to fill unplanned feed deficits can be profitable, although this is dependent on milk price and supplement price, and the length of the feed deficit;
- Using supplements to increase stocking rate and, thereby, create a feed deficit that needs to be filled, results in very expensive 'marginal' milk and is rarely profitable.

Production is vanity; Profit is sanity! Are you vain or sane?

Over the last 20 years, dairy farmers have been presented with two interconnected statements:

1. Profit is driven by pasture utilisation;
2. Average cost of production is your most important profit metric.

The problem with both of these statements is that they are both true and misleading. As a result, their general acceptance has led, unwittingly, to some bad business behaviours.

The truth: it is very difficult maximise profitability:

- if you do not utilise a high proportion of the pasture grown on your farm; and
- if you have high unit costs of production (i.e., c/l or €/kg milksolids; MS).

The truth of these statements is well established in many analyses undertaken over the last two decades (Macdonald et al., 2008; 2011; 2017; Ramsbottom et al., 2015; Hanrahan et al., 2018; Ma et al. 2018).

Misleading: If the statements are true, how can they also be misleading? To answer this, you must understand the concept of marginal milk and the cost associated with producing marginal milk.

What is marginal milk?

Marginal milk is the additional milk produced when you change your system of farming. For example,

- if you fill a feed deficit with supplementary feed, the extra production is 'marginal milk';
- if you use supplementary feed to increase stocking rate (i.e., cows/ha), the extra production is 'marginal milk'.

Marginal milk brings revenue (i.e., greater volume sold + additional livestock sales); but, it also brings additional costs and, often, these costs are much greater than most people consider in simplistic partial budgeting exercises.

The cost of marginal milk

On average, Operating Expenses (c/L milk or €/kg MS) increase with increasing use of supplementary feed. For example,

- a 10% increase in the proportion of the cow's diet as supplementary feed (e.g., from 10 to 20%) increases Operating Expenses by between €0.18 (Ramsbottom et al. 2015) and €0.27/kg MS (Hanrahan et al., 2018) in Ireland;
- a comparable increase in feed use, in New Zealand, increases Operating expenses by €0.23/kg MS (Mark Neal, personal communication).

As long as the average MS price is less than the milk price, however, the business remains profitable (excluding debt repayments) and most people don't consider what it cost them to produce the additional (marginal) milk. Although the average cost of production is very important, by focussing only on average cost of production, you risk using at least some of your profit to pay for the privilege of producing more milk and reducing business resilience to price shocks.

To explain what I mean by this, I have outlined a stylised example in Figure 1.

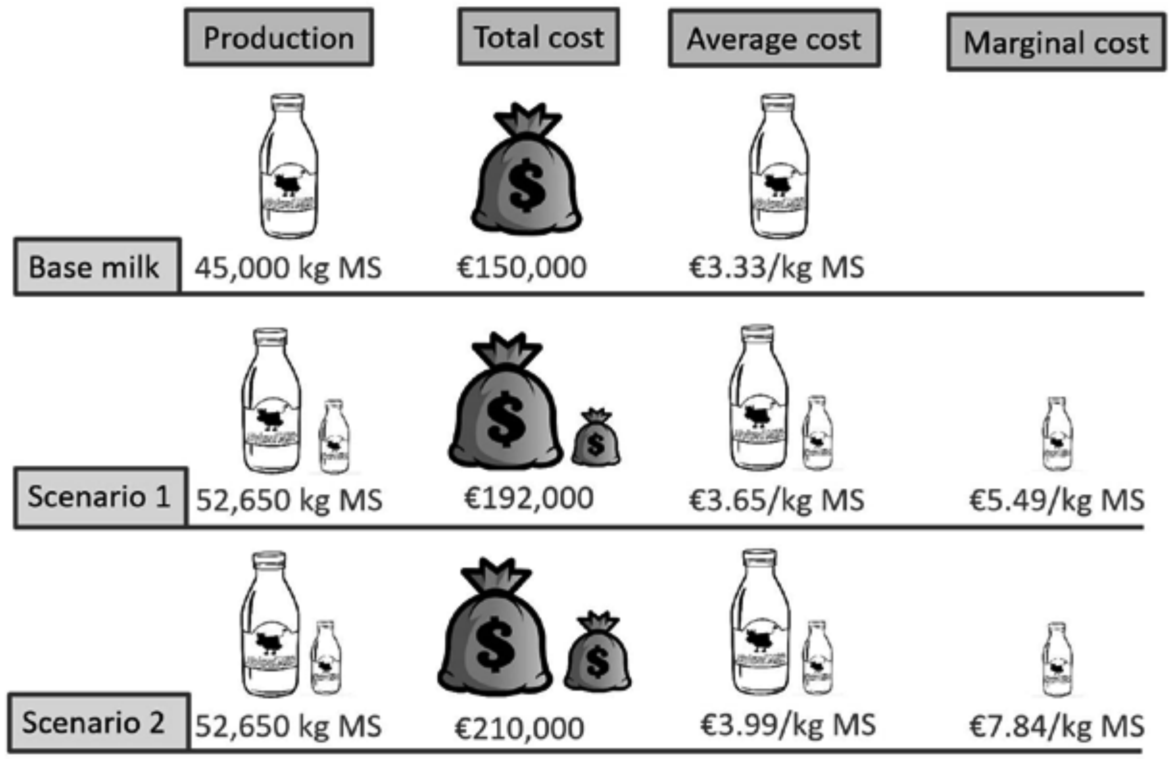


Figure 1. Stylised representation of the cost of increasing milk production. As supplementary feeds are offered, MS production increases but so do total costs and average cost/kg MS.

In the example, Base Milk cost the farmer €3.33/kg MS. In Scenario 1, the changes he/she made increased average Operating Expenses by only €0.32 (i.e., to €3.65) and MS production increased by over 7,500 kg. Changes made in Scenario 2 increased average Operating Expenses by €0.66 to €3.99/kg MS. Simplistically, therefore, we can assume that both Scenario 1 and 2 are profitable, so long as milk price is greater than €4/kg MS (approximately €0.33/L). However, if you examine the data more closely, the cost of the additional milk (i.e., Marginal Milk) produced was:

- €5.49/kg MS in Scenario 1, and;
- €7.84/kg MS in Scenario 2.

Therefore, although in both scenarios, the average Operating Expenses would indicate that all three businesses remained profitable, this was only because the base milk was 'subsidising' the marginal milk. In reality, the additional milk produced would only be profitable at very high milk prices. Let us now consider some experimental evidence and analyses of farm accounts from New Zealand and Ireland.

New Zealand results: In Macdonald et al. 2018, supplementary feeds were used to increase milk production from two Base Scenarios (Table 1).

- Scenario 1: Milk production was increased by increasing stocking rate from 3.35 to 4.41 cows/ha, but importing supplementary feed to maintain the same Comparative Stocking Rate (CSR) of approximately 85 kg Lwt/t feed DM.
- Scenario 2: Milk production was increased by importing supplementary feed to fill genuine feed deficits at a high stocking rate (i.e., to reduce CSR).

Within both of these scenarios, supplements were imported as either concentrate (i.e., maize grain) to feed the cows at milking or as silage, which is comparable with zero grazing or renting land for silage to facilitate an increase in stocking rate on the milking platform. The results are presented in Table 1.

The biophysical results are self-explanatory. Treatments receiving the supplements produced more MS/ha in both Scenarios and more MS/cow in Scenario 2. The marginal milk production response to supplements was 7.5 g MS/MJ metabolisable energy offered, irrespective of supplement type and whether the supplement was being used to increase stocking rate or to fill a feed deficit at a high stocking rate; this response is equivalent to approximately 1 L milk/kg grain.

Operating profit declined with supplement use in this example. But, we were more interested in the analysis of the cost of the marginal milk, as this shouldn't be influenced by the milk price and it provides you with a 'breakeven' price for the marginal milk.

Let us first consider Scenario 2, where stocking rate is high and concentrate or silage is imported to fill feed deficits. Each additional kg MS produced above Base 2 cost NZ$6.33 (maize grain) or NZ$5.54 (maize silage). This means that:

- as long as milk price was more than NZ$5.54, renting land to produce silage for cows on the milking platform or buying silage at a commercially appropriate price did not result in a loss;
- as long as milk price was more than NZ$6.33, using maize grain in the shed to fill the feed deficit created by being at a high stocking rate did not result in a loss.

Table 1. Biophysical details of the farmlet comparison and modelled profitability (Operating Profit and the cost of Marginal Milk Produced) of two scenarios: Scenario 1 measured the effect of using supplements to increase stocking rate, while Scenario 2 measured the effect of using supplements during a feed deficit (Macdonald et al., 2017).

Treatment	Base 1	Base 2	Maize Grain	Maize Silage
Stocking rate, cows/ha	3.35	4.41	4.41	4.41
Supplements, t DM/cow	-	-	1.3	1.1
CSR, kg Lwt/t feed DM	86	113	82	84
MS/ha, kg	1,199	1,175	1,745	1,584
MS/cow, kg	357	267	396	359
Operating profit, $/ha	2,544	1,845	1,390	1,812
Base 2 Marginal milk, NZ$/kg MS		*	6.33	5.54
Base 1 Marginal milk, NZ$/kg MS	*		7.97	7.81

The analysis of Scenario 1, however, tells a very different story. In Scenario 1, supplementary feeds were imported to allow the milking platform to increase stocking rate. This means that the cost of the additional cows is also considered in the cost of the marginal milk produced in this Scenario.

In Scenario 1, each additional kg marginal MS cost NZ$7.97 (maize grain) or NZ$7.81 (maize silage). This means that:

- as long as milk price is more than $7.81, renting land to produce silage for cows on the milking platform or buying silage at a commercially appropriate price was profitable;
- as long as milk price is more than $7.97, using maize grain in the shed to fill the feed deficit created by being at a high stocking rate was profitable.

This comparison of scenarios is very interesting as it allows a complete analysis of the options available (i.e., importing feed or reducing stocking rate). Marginal milk can be very expensive, particularly if the feed is being used to maintain a high stocking rate, irrespective of whether the additional feed is concentrate in the milking parlour or imported silage.

Irish data: Ramsbottom et al. (2015) analysed four years of data in the Profit Monitor database to determine the effect of level of feed use on farm profitability (Table 2). Their data shows that, on average, supplements were used to increase milk production/cow and not increase stocking rate.

Operating Expenses per kg MS increased by €0.18 for every 500 kg DM supplement/cow purchased. Although, all businesses were profitable and Operating Expenses were less than €3/kg MS on farms in all categories over the four years reported, the cost of the marginal milk produced was between €5.50 and €5.70. As a result, Operating Profit declined by €72.20/ha and €0.22/kg MS with every 10% increase in the amount of the cow's diet originating from supplementary feeds (Ramsbottom et al. 2015).

Recently, Hanrahan et al. (2018) analysed 8 years of data from the Irish National Farm Survey and reported that Operating profit declined by €96.50/ha and €0.21/kg MS with every 10% increase in the amount of the cow's diet originating from supplementary feeds. The consistency of the economic response to supplementary feeds in both of these analyses questions the rationale for using supplements to increase MS production/cow and per ha.

Table 2. Biophysical characteristics of Irish dairy farms importing <10, 20, 30, or >40% of the cows' diet from outside the farm (source: Ramsbottom et al., 2015).

Percentage of the cows' diet as purchased feed	**≤10**	**20**	**30**	**≥40**
Herd size, cows	96	83	82	84
Milk/cow, L	4,679	4,974	5,192	5,577
MS/ha, kg	723	769	823	884
Operating Profit, €/ha	1,298	1,257	1,180	1,083
Operating expenses, €/kg MS	2.34	2.53	2.74	2.93
Cost of marginal milk, €/kg MS		**5.51**	**5.67**	**5.60**

Conclusions

There is increasing evidence that milk produced from using supplementary feeds in grazing systems is expensive; furthermore, in general, it is more expensive than the revenue for the marginal milk. In other words, farmers are subsidising the production of marginal milk with the profit coming from the milk produced from pasture.

Supplements used to manage unplanned and short-term deficits may be profitable, depending on the milk price and the supplement price. However, the marginal milk produced in a system designed to import large amounts of feed (>500 kg DM/cow) is almost always more expensive than the milk price.

Further reading

Ramsbottom, G., B. Horan, D. Berry, J. R. Roche. 2015. Factors associated with the financial performance of spring-calving, pasture-based dairy farms. Journal of Dairy Science 98:3526-3540.

Hanrahan, L., N. McHugh, T. Hennessy, B. Moran, R. Kearney, M. Wallace, and L. Shalloo. 2018. Factors associated with profitability in pasture-based systems of milk production. Journal of Dairy Science 101:5474-5485.

Macdonald, K. A., J. W. Penno, J. A. S. Lancaster, and J. R. Roche. 2008. Effect of stocking rate on pasture production, milk production, and reproduction of dairy cows in pasture-based systems. Journal of Dairy Science 91:2151–2163.

Macdonald, K. A., D. Beca, J. W. Penno, J. A. S. Lancaster, and J. R. Roche. 2011. Short communication: Effect of stocking rate on economics of pasture-based dairy farms. Journal of Dairy Science 94:2581–2586.

Macdonald, K. A., J.W. Penno, J.A.S. Lancaster, A.M. Bryant, J.M. Kidd, J.R. Roche. 2017. Production and economic responses to intensification of pasture-based dairy production systems. Journal of Dairy Science 100:6602-6619.

Ma, W., A. Renwick, and K. Bicknell. 2018. Higher intensity, higher profit? Empirical evidence from dairy farming in New Zealand. Journal of Agricultural Economics. doi: 10.1111/1477-9552.12261.

Grazing targets to grow more grass

Richard O'Brien, Teagasc, Kells Road, Kilkenny

& George Ramsbottom, Teagasc, Oakpark, Carlow

Background

Grass based milk production was seriously challenged across the country and in particular the south and east during the summer of 2018. PastureBase Ireland has reported an average pasture grown at 10.8 tons DM/ha a reduction of approximately 3.5 tons DM/ha compared to 2017. I estimate that the monitor farms in the Teagasc Glanbia Joint Programme produced approximately 3 tonnes of dry matter less per hectare in 2018 compared to the previous year and to compensate for the deficit they had to feed an extra 1 tonne of concentrate feed per cow per cow. Grass targets and grazing practices had to be revised considerably during the year to cope with the poor spring and drought we experienced in 2018. Therefore it's timely now to revisit the targets for the coming grazing season.

Targets underpinning stocking rate

At the 2013 Moorepark Open Day, Brendan Horan and John Roche presented the following table which summarised optimum stocking rate for different tonnages of annual grass grown.

Table 1. Stocking rate (cows/ha) that optimises profit on farms growing different amounts of pasture and feeding different amounts of concentrate/cow[3].

	Pasture grown (t DM/ha)			
Concentrate (t DM/cow)	**10**	**12**	**14**	**16**
0.00	1.5	2.0	2.3	2.6
0.15	1.7	2.1	2.4	2.8
0.50	1.8	2.2	2.5	3.0
1.00	2.0	2.4	2.9	3.2
1.50	2.2	2.6	3.1	3.5
2.00	2.4	2.9	3.3	3.9

In Table 1, the optimum stocking rate for farms that produce different amounts of pasture and feed different amounts of concentrate supplement are defined. For example, if a farm can grow 10 t DM of pasture on average and the system involves feeding 0.5 t concentrate DM/cow, the stocking rate should be 1.8cows/ha. In comparison, a farm capable of growing

[3] The proposed stocking rate of a resilient system is highlighted.

16 t DM pasture/ha and feeding 0.5t concentrate DM/cow should be stocked at 3.0 cows/ha.

The national average pasture grown on Irish dairy farms is approximately 10 tonnes – assuming a planned concentrate feeding level of 0.5 t DM/cow (approximately 600 kg/head), the appropriate stocking rate for that farm is 1.8 cows per hectare farmed. The figure that I use when calculating whole farm stocking rate is a pasture grown figure of 5.5 tonnes required per cow (assuming approximately 800 kg of meal fed per cow) and a milk solid yield of 450 kg of milk solids per cow is being achieved. A farm growing 15 tonnes of grass dry matter on every hectare can therefore comfortably support a stocking rate of approximately 2.5 cows/ha with minimal meal input (600-800kg/cow).

Setting targets

Achieving a 15 ton grass yield is not without its challenges with targets set for different seasons of the year (Table 2). The farm will be badly set up for the year if the first rotation is not started on time. Mid – season has 6 rotations of 20 days on average. The last rotation is the start of the next grass year.

Table 2. Seasonal grass dry matter yield targets to achieve an annual grass yield of 15 tonnes dry matter per hectare.

Growth period	Grass grown per rotation (kg DM/ha)	No. of rotations	Daily growth rate required (kg DM/ha/day)
1st Jan – 10th Apr	1,400	1	13
11th Apr – 5th Aug	1,400	6	70
6th Aug – 30th Aug	1,700	1	65
1st Sept – 30th Sept	1,850	1	55
1st Oct – 15th Nov	1,550	1	30
Total		**10**	

The data in Table 2 presents the growth targets for spring, summer and autumn to achieve a 15 tonne dry matter grass yield per hectare. In this presentation I will concentrate on the management actions required for each of the three seasons.

Spring management

The targets contained in the Teagasc spring rotation planner have been widely used by grass based dairy farmers.

Go early

We know from PastureBase records that on average only 20% of the milking platform is typically grazed in the month of February. The target for dry free draining farms is that 30% should be grazed by the end of the February (for obvious reasons on wetter farms this target should be achieved approximately 2 weeks later). From the experience of the monitor farms achieving a target of 30% grazed is important but that achieving 15% grazed by February 15th is critical in ensuring that a sufficient number of days have elapsed (approx. 60 days) between first grazing and the start of the second rotation in early April. To achieve this target, the first paddocks grazed will invariably include mostly covers of between 600-800 kg DM/ha in order to get the required area when cow numbers and intake are low. If silage ground is available in the first round, graze it after grazing 50% of the area available for the 2nd round. In addition this early grazing target won't be achieved without early compact calving of the dairy herd. The type of cow is complementary to achieving the early grazing target as well.

Looking back

Once the first 30% is grazed, it is important to begin monitoring the recovery of the early grazed paddocks from early March. This will indicate how quickly these paddocks are initiating recovery and provide an early indicator of the likely quantity of grass available for the start of the second rotation. Don't graze blindly on the basis of target area being grazed or you could run short of grass for the start of the second rotation when the number of cows and their dry matter intake requirement has increased considerably.

Typically in early March, we expect that the earliest grazed paddocks will have a cover of approximately 400-500 kg DM/ha and by March 20th, a cover of approximately 800-900 kg DM/ha. Under normal circumstances such paddocks will have a cover of 1,200 kg DM/ha by early April and are ready for their second grazing. If grazed paddocks have not reached a cover of 800 kg DM/ha by mid-March, then extra supplementation will need to be introduced to extend the first grazing rotation in order to achieve a pre-grazing herbage mass of 1,200 kg DM/ha.

Get ahead of yourself

Invariably during the first 60 days of the grazing season (between early February and early April) there will be periods of both dry weather when grazing conditions are favourable and wet weather when grazing conditions are poor. It is important to seize the opportunities presented by dry weather to graze ahead of target. Invariably cows will need to be housed even by night and slow down grazing progress during wet weather in spring as well.

If at the end of March the farm is short of grass having grazed out the whole farm, yes it will require additional supplementation at that stage but at least the farm has been set up for the year ahead. Maintaining an average farm cover of no less than 500 kg DM/ha at the end of the first round is also important. Why? Allowing further decline will delay recovery as April progresses.

Spring reseeding

Put a reseeding policy in place for your farm early in the year. Plan to reseed 10 – 15% per annum. A spring reseed will produce as much dry matter in the year of establishment as old permanent pasture. Prioritise silage fields and then pick out your poorest growing grazing fields. Fields that are well managed and fertilized can maintain good growth for over 10 years. Perennial rye grass is far less persistent in two a cut silage system.

Wet weather management

In spring, ground and weather conditions can prove difficult and thereby reduce opportunities for grazing. Early spring grazing improves the overall grass growth potential but avoid poaching or growth rates will be reduced. The yield reduction will vary depending on the level of damage incurred, but can be between 30-50% reduction for the second grazing rotation.

The technique known as 'on/off grazing' has an important role to play on all dairy farms. This is an approach where cows graze for a limited period (2-4 hours) after each milking. The aim of on/off grazing is to strike the balance between feeding cows adequately while at grass and minimising the level of pasture damage. This strategy should be implemented during periods of wet weather/poor ground conditions to increase the number of days at grass. Turning out cows with an enthusiastic appetite (i.e. hungry) for grass is also critically important to the success of this strategy as the cows need to concentrate on grazing and nothing else. Cows tend to do most damage to swards when they are not grazing intensively by wandering around. Cows can become restless and move around particularly during wet weather.

Dairy cows have two main grazing bouts during the day. The first and main grazing bout occurs early in the morning typically after morning milking. The second grazing bout occurs later in the evening after milking. Previous studies have shown that dairy cows have a natural inclination to graze after a period of fasting. This helps explain why cows have grazing bouts after both milkings. The aim behind the concept of on/off grazing is to take advantage of the cows own natural instinct to graze after each milking when given access to grass. Research indicates that on/off grazing results in similar milk solids and bodyweight in dairy cows as that of cows that had full access to pasture.

Cows generally adapt to the on/off grazing system after about 2 days. For practical reasons, the evening milking should be carried out earlier in the evening (e.g. 3pm) so cows that are on an on/off grazing regime are brought in at 7-8pm in the evening. Farmers should select the most appropriate paddocks and back fence the cows to prevent damage. Avoid vulnerable paddocks and paddocks with poor access. Paddocks with lower covers are more suitable for on/off grazing and an increased. Residual height of grass is acceptable in order to prevent damage to the sward.

Irish Grassland Association

Membership Subscription Form

PERSONAL DETAILS

(BLOCK LETTERS PLEASE)

Name ______________________________

Address ______________________________

____

____

____

Home number ______________________________

Mobile number ______________________________

Email address ______________________________

Are you involved in: Dairy ☐ Beef ☐ Sheep ☐

Do you wish to receive occasional updates via Text?

Yes ☐ No ☐

DAIRY CONFERENCE 2019 MEMBERSHIP OFFER

Get membership to the IGA for 2019 for FREE for all new direct debit members who sign this up form in full and return to the IGA office on or before 31st January 2019.

This offer is not available to existing members and is not in conjunction with any other membership offer.

SEPA Direct Debit Mandate

Irish Grassland Association

SEPA Direct Debit Mandate ______________________________

Unique Mandate Reference (UMR) – to be completed by the Irish Grassland Association

By signing this mandate form, you authorise (A) the Irish Grassland Association to send instructions to your bank to debit your account and (B) your bank to debit your account in accordance with the instructions from the Irish Grassland Association. As part of your rights, you are entitled to a refund from your bank under the terms and conditions of your agreement with your bank. A refund must be claimed within 8 weeks starting from the date on which your account was debited.

Please complete all the fields marked *.

Debtor Name / Your Name	*	
Debtor Address / Your Address	*	
Town	*	
City	*	
County	*	
Debtor account number – IBAN	*	
Debtor bank identifier code – BIC	*	
Creditor's name	*	I R I S H G R A S S L A N D A S S O C .
Creditor identifier	*	I E 5 0 S D D 3 0 5 8 4 6
Creditor address	*	C O O K S T O W N
Town	*	K E L L S
County	*	C O . M E A T H
Country	*	I R E L A N D
Type of payment	*	Recurrent payment ☐ or One-off payment ☐
Date of signature	*	

Signature(s)

Please sign here *

Note: Your rights regarding the above mandate are explained in a statement that you can obtain from your bank.
Please send this mandate to the creditor (Irish Grassland Association, Cookstown, Kells, Co. Meath.)

Summer management

This is the most important period because it includes 6 grazings each of 1,400 kg DM/ha (Table 2). The two main criteria for successful summer grazing are:

- Maintain pre-grazing yields of 1,400 kg DM/ha throughout the period (two fists of grass);
- Maintain a 20 day rotation across the period – 30% of the land area grazed per week.

Average farm cover (AFC) should be maintained at between 500-600 kg DM/ha almost independently of stocking rate. At lower stocking rates (e.g. <2.5 LU/ha) operating at a lower AFC will lead to low pre-grazing yields compromising grass dry matter intake (and growth rates) and animal performance. At higher stocking rates, (e.g. 4.0 LU/ha or greater), operating at higher AFC will result in higher pre-grazing yields and compromise grass quality.

In periods of high growth rate (e.g. >70 kg DM/ha/day) it is important to walk the farm every 4-5 days to assess AFC. Having identified surpluses, **trust your figures <u>and</u> remove the surpluses quickly** from the system to ensure a quick recovery of the paddocks harvested. A surplus is only a surplus on the day it is identified and if it is allowed to bulk up to increase silage harvested it will reduce recovery time and may result in a drop in AFC.

Below are some of the comments from some dairy farmers as to how they view summer grassland management:

- *It is easier to manage a deficit than a surplus*
- *Know your daily demand*
- *Do a back calculation to assess intakes and calibrate your eye*
- *Be flexible – use meal or silage if you need to*

Autumn management

There are two stages encompassed by autumn management:

1. Building cover (from August 15th to September 30th);
2. Rationing out the final rotation (from October 1st to the end of the grazing season).

Building cover

Grass build up begins in mid-August. Ideally peak cover should occur between mid- and late-September. Regardless of stocking rate, the peak AFC should be no more than 1,000 kg DM/ha because paddocks are easier to graze out, quality is better and recovery quicker when the pre-grazing yield of the heaviest paddocks is no more than 2,200 kg DM/ha.

Rationing out the final rotation

At this stage we are setting the farm up for next Spring. Start the final rotation in early October. People often ask 'is this paddock closed?' The answer invariably is 'I'll answer that in November when we see what the recovery is like.' Typically farmers should aim to close 60% (70% on highly stocked farms) of the grazing area by early November. The paddocks grazed in early October will usually be grazed in early-mid March. Those grazed in the second half of October are usually grazed in February. The remaining 40%, grazed in November, should be grazed from mid-March onwards. Don't forget to rotate the heavy over winter cover paddocks between years as this can result in tiller loss and sward deterioration if repeated year after year. The closing AFC on the 1st of December should be greater than 650 kg to have an opening cover of 1,000 kg DM/ha the following February.

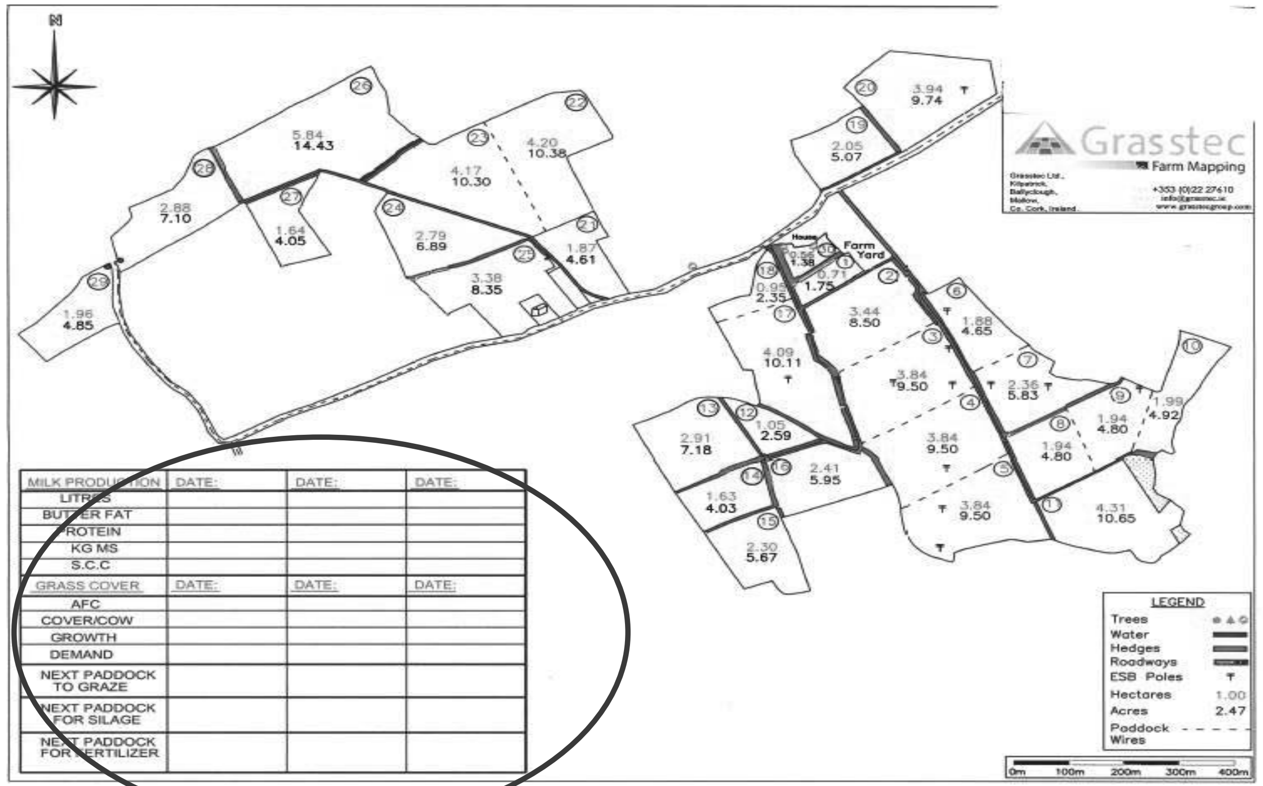
Where should I be now?

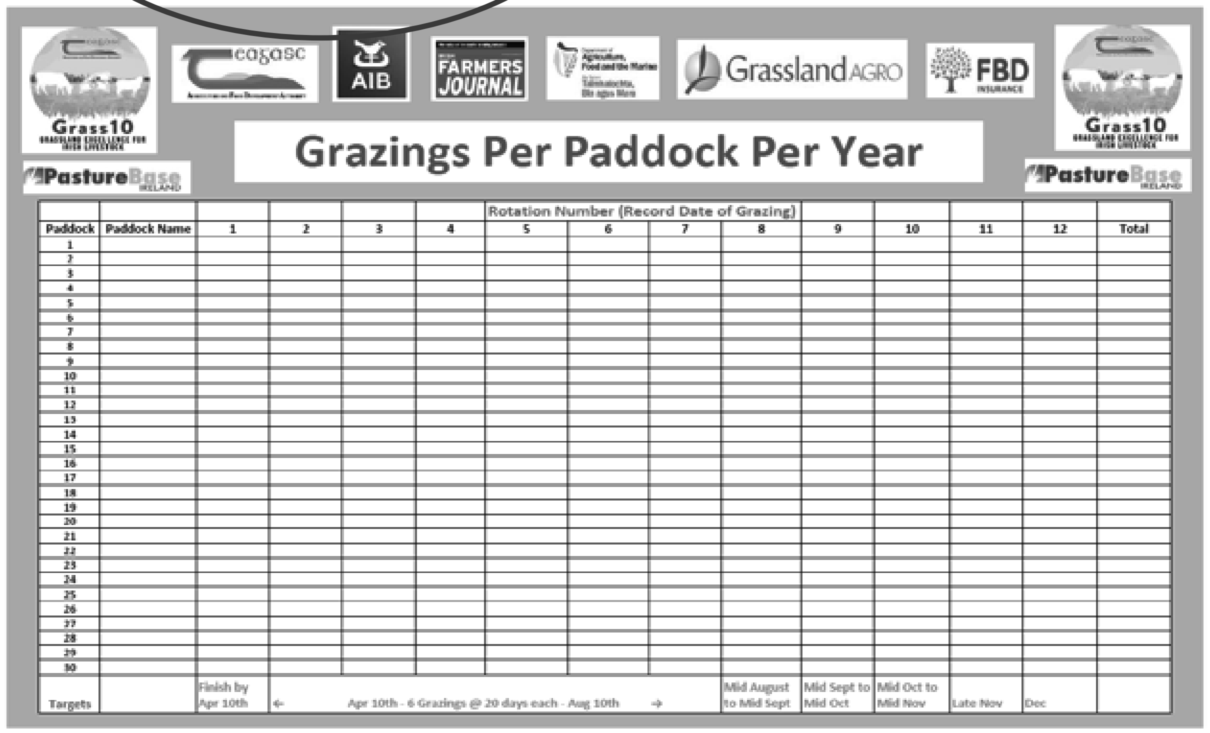
Spring calving dairy farmers in early January should have an AFC of 800-900 kg DM/ha in early January.

- Set up my grazing management board (map of the farm and rotation planner)
- This can be established by walking the farm and calculating a farm cover within the next week or so (before calving starts).
- Identify the first paddocks for spring grazing – they should have a cover of 500-700 kg DM/ha in early January.
- Identify the first 30% to graze.
- Have the divisions ready for February grazing.
- Sign up for PastureBase and record the covers on the programme from the start of the 2019 season to estimate the annual tonnage grown for the year.

Appendix 1.

Essential boards for efficient grassland management





Fertiliser targets to maximise grass dry matter production

Stan Lalor[1] and Michael O'Donovan[2]

[1]Grassland AGRO, Dock Road, Limerick

[2]Teagasc, Animal and Grassland Research and Innovation Centre, Moorepark, Fermoy, Co. Cork.

Summary Points

- Requirements for P and K for soil fertility maintenance are driven largely by the amount of grass grown and utilised.
- Front load P application in the spring to stimulate early grass growth.
- Apply K late in the year where high K applications are required.
- Aim for slurry to go to silage fields, paddocks cut for surplus grass and/or paddocks with low soil K levels.
- Balancing N with S applications over the year at a ratio of 12 N : 1 S can help increase the utilisation of N by the sward.
- Early spring N application under suitable soil moisture and temperature is an important driver of spring grass growth in swards with high ryegrass contents.
- A fertiliser plan is essential. A simple overall plan of products, rates and timings should be put in place, with low fertility fields being addressed with simple switches in spring for low P soils, and in the autumn for low K soils.

Introduction

2018 will be considered by many as a year to forget in terms of grass production for climatic reasons. Reviewing the challenges of the year bring an opportunity to re-think expectations of grass production potential, and review how the management of the soil and swards on the farm can be optimised for the future grass production and sustainability of the farm. This paper sets out simple advice for soil fertility and fertiliser management to address key challenges of 1) phosphorus (P) and potassium (K) requirements for grazing; 2) fertilising silage as a crop; 3) best use of slurry within the farm; 4) role of sulphur (S) in nitrogen (N) response; 5) maximising spring growth; and 6) putting a fertiliser plan in place.

This paper does not mention soil pH and lime in any major detail. Since soil pH has such a major fundamental impact on the fertility of the soil, all the advice that follows is based on the premise that soil pH is being managed by lime applications as required. If low soil pH is an outstanding issue on your farm, then this is an essential first step that must be addressed

in tandem with the advice that follows on fertiliser and nutrient management. We must acknowledge that steps are been taken on farms to address low soil pH, but there is still a long way to go to bring the national situation up to the optimal levels.

1) Phosphorus and Potassium requirements for grazing

The requirement for phosphorus (P) and potassium (K) for grazed swards is often something that can get very complicated to calculate when all the commonly mentioned factors of influence (e.g. stocking rate, baling surplus grass, soil test Indices, etc) are all thrown together. A simple way to consider the P and K requirement is shown in Table 1. By taking a starting point of considering the P and K required to grow 1 tonne of grass dry matter (DM), it is possible to work up to a P and K requirement for soil fertility of a grazed sward. Assumptions in this approach include typical P and K concentrations in grass DM of 4 and 30 g/kg of DM, respectively. Also assumed are the proportions of P and K intake that are retained by the cow (40% and 10% for P and K, respectively), with the balanced assumed to be returned to the soil in dung and urine.

Table 1. An approach to establishing P and K requirements for maintenance of soil fertility under grazing based on grass growth, utilisation and nutrient retention by grazing animals. Additional P and K rates required for soil fertility build-up are also included.

	P (kg/ha)	**K (kg/ha)**
Uptake required from the soil to grow 1 t/ha of grass DM for grazing	4	30
Uptake required to grow 15 t/ha of grass DM	60	450
Nutrients eaten by cows (or cut for silage) assuming 80% utilisation (12 t/ha of utilised grass DM)	48	360
Approximate retention by the animal (i.e. not excreted in dung and urine)	40 %	10 %
Nutrient removal by grazing animals (Soil Fertility Maintenance)	**19**	**36**
Additional requirement for soil Index 2 (above maintenance)	+ 10	+ 30
Additional requirement for soil Index 1 (above maintenance)	+ 20	+ 60

Based on the assumptions shown in Table 1, the typical P and K requirements for soil fertility maintenance for a pasture where 12 t/ha of grass DM is utilised are approximately **19 kg/ha** of P and **36 kg/ha of K**. These will increase or decrease with higher or lower levels of grass production and utilisation. Also worth noting is that additional P and/or K will be required where soil Index levels are low (Index 2 or 1). Higher rates of additional P in low Index soils than those shown in Table 1 are permitted under the current Nitrates Regulations, provided the farm meets specific eligibility criteria. However, in all cases, any plan for the farm regarding fertiliser must be cross-checked with permitted fertiliser N and P rates under the Nitrates rules.

When to apply Phosphorus (P)

On mineral soils, having P applied earlier in the spring to support early growth has been shown to be beneficial to boost grass growth. Swards with a grass growth response to P fertiliser normally show that a high proportion of the additional grass is grown in spring. The programme for applying P fertiliser across the year should be to front load P in spring, with a target to get between 50-75% of the annual P requirement applied in the first 2 rounds of fertiliser. The remaining balance of the annual P fertiliser rate should then be applied in little and often applications across the summer months, as relatively low application rates of P during the peak grass growth period can improve the P concentration in the grass to help meet dietary requirements of the cows. Where additional P is applied on low fertility mineral soils, front-loading this P in spring is recommended, and action to supply additional P to low fertility soils is essential if low fertility is to be addressed and improved.

Timing of P should be different on peaty soil types (high organic matter and usually very dark brown or black in colour). Unlike mineral soils, peat cannot hold onto P to the same extent, and therefore a more even distribution of the P requirement across the whole year is more appropriate than high applications in spring. Also with peats, additional P applications to improve soil fertility are not recommended as the peats cannot hold onto P in the same way that mineral soils can.

When to apply Potassium (K)

Fertiliser K applications generally go hand in hand with P applications due to the typical usage of NPK compounds for supplying P. Applying K in spring is not as critical as P for spring grass. For maintenance requirements, applying the P and K together will generally work well. It is important to avoid high rates of K in the spring period as excess K at this time can impact negatively on the uptake of magnesium (Mg) by grass, resulting in an increased risk of grass tetany. Where additional K is required for soil fertility build-up, it is generally better to apply the additional K in the autumn period.

The impact of cutting rather than grazing

One of the advantages of considering P and K requirements within the approach shown in Table 1 is that it highlights very clearly the impact that cutting has on P and K removal compared to grazing. The difference arises due to the high proportion of nutrients that a cow recycles back to the soil during grazing. Where a field is grazed all year, the 12 t/ha of utilised grass results in a nutrient requirement of 19 kg/ha of P and 36 kg/ha of K. This gives a P:K requirement ratio of approximately 1:2, which reflects common NPK products used for grazing such as 27-2.5-5 and 18-6-12. In the absence of grazing, it can also be seen in Table 1 that if the 12 t/ha of DM were removed from the field by cutting, the P and K requirement is a lot higher, being 48 kg/ha of P and 360 kg/ha of K. This also means that the P:K ratio

required in a fertiliser product for silage should be closer to 1:6 or even up to 1:7. Basically, you need a lot more K for silage than for grazing, because the cow leaves most of the K behind her when she's grazing!

2) Fertilising Silage as a Crop

Having a good stock of silage in the yard might be described as a bit like electricity – you don't really appreciate it until you don't have it! The past year and the winter ahead are a good example of the importance of having a good silage crops to provide winter feed and forage buffers. There has been an increasing emphasis on a lot of farms on silage being an opportunistic exercise as a means of managing the grass wedge over the summer months. Over-dependence on this to meet silage requirements becomes a risky strategy if an adequate plan is not in place to grow silage crops with good yield and quality. Two important reasons why this is important are: 1) silage crops with high covers have very high growth rates capacities during the latter part of their growth cycle, thus providing a big opportunity to accumulate grass dry matter compared to swards with lighter covers more typical of grazing; and 2) silage as a crop has a higher nutrient demand compared to grazing and needs to nourished adequately to achieve its potential.

As previously discussed regarding the P and K requirements shown in Table 1, silage has a higher P and K demand than grazed swards. Guideline requirements for P and K for first and second silage crops are shown in Table 2. While general advice for each cut is useful, it is the grass DM harvested that is the real driver of the P and K requirements that need to be returned to silage fields. Grass with heavy covers cut for silage tend to be more mature than lower covers that are grazed, so slightly lower concentrations of P and K are assumed for heavy silage crops than for grazed swards.

Table 2. Guideline P and K requirements for first and second cut silage crops based on target yields of 5 t/ha and 4 t/ha of grass DM respectively. Rates shown refer to soil fertility maintenance only. Additional P or K for low soil Index situations should also be included in the overall fertiliser plan for the year.

	P (kg/ha)	**K (kg/ha)**
Uptake required from the soil to grow 1 t/ha of grass DM for silage	3.5	25
P and K requirement for **First Cut (5 t/ha of grass DM)**	18	125
P and K requirement for **Second Cut (4 t/ha of grass DM)**	14	100

Impact of taking paddocks out for bales

While a round of bales may seem like an insignificant change to the usage of a paddock, over time, the impact of a few rounds of surplus bales can have a big effect on changing the

P and K required in the paddock. The reason for this goes back to the cow's ability to recycle P and K in the paddock while grazing compared to silage which removes everything. One could get very precise with a fertiliser plan that switches the fertiliser product that might be used to increase the P and K in a round of fertiliser following a round of bales rather than grazing. However, this can add to the management headache by having to keep additional products in the yard, and also potentially making every round of fertiliser more complicated.

Every 1,000 kg/ha of grass DM cover that is cut for bales rather than grazed will add approximately 2.5 kg/ha of P and 25 kg/ha of K to the overall P and K requirements for maintenance to a paddock across the year. Just one round of bales taken with a cover of 2,000 kg/ha could more than double the K removal from a paddock over the course a year. The simplest way to manage this change in P and especially K is to target slurry to be returned to paddocks that are cut for bales as the balancer for the higher P and K offtake. The recycling of the P and K in the bales by the cows still happens, but it happens indoors, therefore get the slurry back to re-balance the system. If slurry is used like this, it keeps the fertiliser plan very simple afterwards.

3) Best use of slurry within the farm

There is a lot of emphasis put on the value of slurry, with estimates of €20 and €25 per 1,000 gallons typically being quoted. If you had to buy a 50 kg bag of fertiliser that was equivalent to the nutrients in 1,000 gallons of slurry, you would have a product with an NPK value of approximately 5-5-30. There are a few key points worth considering to actually achieving this level of value.

P and K ratio in slurry

It was highlighted in Section 1 this paper, that the ideal P:K ratio in a fertiliser product for grazing (1:2) is very different to what you need for a silage crop (1:6 - 1:7). The P:K ratio in slurry is 1:6, so it is very apparent that slurry is a far better fertiliser for silage than for grazing. This is logical when in most spring calving systems, the majority of the diet during housing is grass silage. So it makes sense that the nutrient profile in the slurry produced by the animals matches closely with that of the silage being fed.

Therefore, it makes sense when managing slurry to try to get it back to silage ground as much as possible. This can be either the fields used for the main silage crops, and for paddocks cut for bales. Spreading a lot of slurry on the grazing block may be required for practical reasons of land fragmentation of soil trafficability limitations. Be aware that if the grazing block is getting most of the slurry, it is going to be over-supplied with K, and the silage ground will become run down for K if it is not getting additional K from another source to balance the silage crops.

Dilute slurry

If slurry is half-water, then it only has half the nutrients! A lot of farmers make the mistake of not adjusting the application rates for dilute slurry. The 50 kg bag of 5-5-30 equivalence of 1,000 gallons of slurry mentioned above relates to 'thick' slurry. (In its simplest sense, 'thick' slurry equates to approximately 7% dry matter content and could be subjectively described as slurry that is just watery enough to be agitated without adding more water).

Where slurry contains significant additions of water, as is common in housing systems where the slurry tank receives wash water from the dairy and parlour, and/or where slurry is stored in uncovered outdoor tanks, the content of P and K is reduced. So, for a slurry that is 50% water, the 50 kg bag of fertiliser value would be more like 5-2.5-15. As a result, if a dilute slurry is being depended on for supplying P and K for silage, then the rate needs to be twice as high as it would be with thick slurry to get the same application rate of P and K.

Slurry as the P and K source for silage

The rates of slurry required to supply the P and K requirements for silage are shown in Table 3. Rates are shown for 'thick' and 'watery' slurry, highlighting the need for higher application rates where slurry is diluted with water. Rates of slurry required for cutting of surplus grass are also shown as guidelines for factoring in slurry application as a P/K balancer where paddocks are cut rather than grazed. In some cases, application rates can get very high, so it will often be appropriate to split applications across multiple timings. While it is not essential to have P and K or slurry applied exactly before or after swards are cut for silage, it is useful to adhere to the principle of applying these rates of slurry over the course of the year within timings that are practical to the situation on the farm.

Table 3. Slurry application rates of 'thick' and 'watery' slurry required to supply the P and K requirement for silage crops. Rates shown refer to soil fertility maintenance only. Additional P or K for low soil Index situations should also be included in the overall fertiliser plan for the year.

	'Thick' slurry *(7% DM)*	**'Watery' slurry** *(3-4% DM)*
Slurry required for **First Cut (5 t/ha of grass DM)**	3,500 gals/acre	7,000 gals/acre
Slurry required for **Second Cut (4 t/ha of grass DM)**	2,500 gals/acre	5,000 gals/acre
Slurry required for every 1,000 kg/ha of surplus grass for bales	700 gals/acre	1,500 gals/acre
Approximate P and K equivalence of 1,000 gallons of slurry as number of bales of silage as surplus grass	4 bales	2 bales

4) Role of sulphur (S) in nitrogen (N) response

Nitrogen (N) and sulphur (S) go hand in hand in how they work within the grass plant, as both have a critical role for making plant protein. There are millions of proteins in nature, but they all fundamentally are made from a relatively small subset of approximately 20 distinct 'building blocks' called amino acids. Various combinations of these amino acids result in the vast multitude and variety of proteins. It is analogous to how the millions of words we use in the English language are derived from varying combinations of only 26 letters!

The link between N and protein is well understood because every one of the amino acids required to make protein contain N. So, without N, the grass can't make any amino acids, and without amino acids, it can't make protein. One of the most common forms of protein present in grass is contained in chlorophyll; which is a component in plants involved in converting the energy from the sun into sugars during photosynthesis. Chlorophyll is also the pigment in grass that makes it green. Hence the association of pale / yellow swards with N deficiency, as yellow swards lack chlorophyll, which indicates a protein deficiency in the grass which could be caused by lack of N.

Every amino acid contains N. Two of the essential amino acids also contain S, hence the linkage between N and S. A sward could have more than enough N available to it, but if it is missing enough S to balance it, it cannot produce the full range of amino acids that is needs to produce protein. It will have a surplus supply of the ones that have just N, but the 2 amino acids that require N and S will be in short supply, and therefore restrict to grasses ability to make the protein it needs. It would be a bit like trying to write all of the words dictionary if you were missing 2 of the letters!

The balance of N and S supply to the grass through the soil is therefore critical in order to ensure the efficiency of N is optimised. Over the course of the year, applying N and S at a ratio of approximately 12:1 is a good target to keep N and S in balance across the year. So if the N programme is approaching 250 kg/ha, then 20 kg/ha of S over the year would fit well. In terms of timing, splitting S across 3 to 4 timings during the year is better, as S behaves similarly to N in the soil and therefore is well suited to a little and often application approach. As a rule of thumb, aim for S to be included in one of the first 3 rounds in spring, and then with every second round of fertiliser in the grazing season. It will also be influenced by the S content in the products being used.

5) Maximising spring growth

There is always an element of debate around the right approach for N application in spring. The dilemma usually hinges around the knowledge that N applied in early spring is normally less efficient in terms of kg of grass DM grown per kg of N applied. The high value associated with grass availability in early spring means that even relatively small additional quantities of grass can be a big help to the overall feed budget.

The breakeven response required for N in terms of grass production will vary with grass value and N fertiliser price. A response of 4-6 kg of extra grass DM grown per kg of N applied would be normally required to reach a break-even response to cover the cost of fertiliser.

Applying N in spring in a way that maximises the response is important both to ensure good return over cost, and also to help minimise potential losses of N from the soil either to water or as gaseous losses. Improving the efficiency of N use during this period is a major opportunity for improving environmental credentials associated with N efficiency in the future.

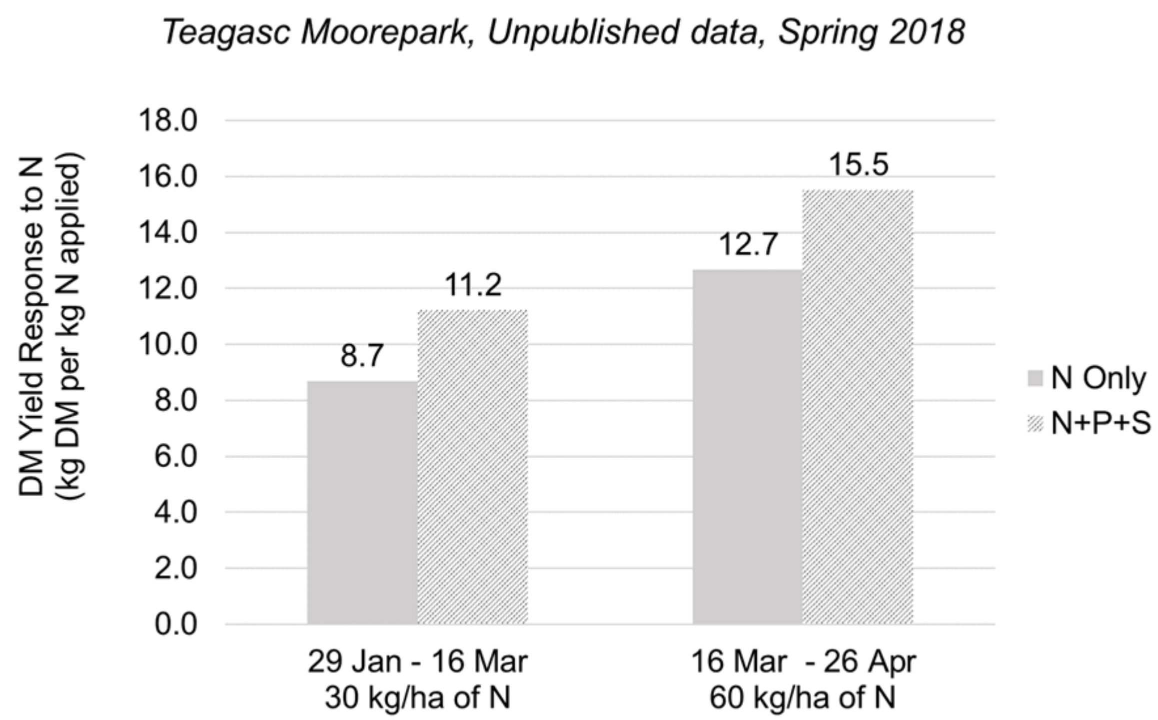


Figure 1. Grass DM yield response to the first (30 kg/ha of N applied on 29 January and cut on 16 March) and second (60 kg/ha of N applied on 16 March and cut on 26 April) applications of N (N only) and N with P and S (N+P+S) in spring. (Teagasc Moorepark, 2018. Unpublished data).

Some useful guidelines are worth considering around decision making on spring N. Firstly, early spring growth will be influenced by the genetic capacity within the sward to respond the N application. Newer swards with high ryegrass contents will be more likely to respond to N than older more diverse swards. Soil factors driven by soil texture in combination with weather will also influence N response. Colder soils are obviously slower to respond, and a rule of thumb of soil temperatures reaching 5-6^{o}C and rising as a guideline for first N application is worth noting when deciding on timing in early spring. Likewise, soil drainage plays a big role as land that is more prone to extended waterlogging and poor trafficability for extended periods in most springs is less likely to respond to early nitrogen.

Attention to deciding on the spring N strategy is important, and may result on holding back on N applications in some areas of the farm. It is still important to apply N fertiliser on fields where a response is more likely. Despite the poor growth conditions on average in spring 2018, the data summarised in Figure 1 based on a trial in Moorepark shows that even in a difficult spring, there was still a response of 8.7 kg grass DM per kg N applied from the first round of N, and a response of 12.7 kg per kg N in the second round of N. These rates of response, albeit achieved under good sward and soil type conditions, are well above the break-even rates of 4-6 kg per kg. Based on these levels of responses, the farm would have had a deficit of over 1200 kg/ha of grass DM if spring N application was delayed to April. This would be a lot of grass to be missing during the spring period.

6) Putting a simple fertiliser plan in place

Bringing it all together into a simple and easy-to-use fertiliser plan is essential in order to put good fertiliser management into practice throughout the year. A plan needs to simple in terms of number of products required, both in total over the year, and more critically at any single application timing. A plan should also be designed to be consistent across the farm for as many rounds of fertiliser as possible, as this will help to keep it simple to implement. A plan must also factor in the one or two key adjustments so that fields that are low (or very high) in fertility get the necessary treatment to address these issues.

Build a simple back-bone plan for the farm

A simple back-bone plan for the farm is a general plan for the 'average' situation on the farm. Begin by breaking down the year into 3 periods and target the key nutrient priorities in each timing window. The main targets and approach for each timing window are shown in Table 4.

Nitrogen and S are important in all 3 periods, and balancing N with S at a ratio of approximately 12:1 within each timing window is a good guideline. Applying some S within each window rather than applying all of the S for the year in a single round is a better strategy to have a more stable supply of S to the grass for the full growing season.

In spring, P is a key nutrient to help kick-start spring grass growth and help stimulate rooting and tillering in the cooler spring conditions. Phosphorus mobility in the soil is normally low at all times. However, P availability is further challenged under cooler soil conditions in spring. Therefore, the input of a supply of available P in fertiliser will help increase spring grass growth. Historical research has clearly shown that the main period where grass growth benefits are achieved from P input are in the spring period. Therefore, the target is to apply 50-75% of the annual P allocation in one of the first two rounds of fertiliser.

Table 4. Time periods, nutrient priorities and fertiliser product guidelines for a simple 'back-bone' programme for the grazing platform for the year, along with targets for making simple adjustments for low soil P and low soil K situations.

Time period	Rounds of fertiliser	Priorities	Example 'Back-bone' programme	Adjustment for low soil P	Adjustment for low soil K
Up to Mid April	2-3	N S in at least one round 50-75% of annual P Avoid high rates of K	1) Straight N 2) NPK compound (e.g. 18-6-12) (aim for 50-75% of overall P) 3) Straight N 4) Include S in one of these rounds	Use a compound (or straight P) with higher P in one of first two rounds.	
Mid April to July	4-5	N S in every second round (12:1 with N averaged over the period) Low rate of P in alternate rounds	Alternate straight N with a compound with low PK (e.g. 27-25-5) Include S in every second round		
Aug onwards	2	N S in 1 round Low rate P K where high rates required	One round of compound with low PK (e.g. 27-25-5) One round straight N Include S in one round		Apply additional K to low K soils as: - slurry, - straight K fertiliser (e.g. muriate of potash), or - N:K compound in final rounds

For the remainder of the year, alternate straight N fertiliser with a compound fertiliser with low P and K levels. While the major benefit of P in terms of grass yield is more likely to occur in spring, there is still a benefit to low rate applications of P over the summer to help increase the P concentration in the grass to better meet the dietary requirements of the cows.

The general principle of the nutrients and product types to target are shown in Table 4. However, the correct allocation of specific products and rates will depend on the soil fertility, stocking rate and grass growth targets specific to your farm. The key message is to put a 'back-bone' plan in place along these principles that is simple and easy to follow in terms of products and rates at each timing.

Adjustments for low P and low K

Making simple adjustments to the plan for the fields that are low in P or K is important. These adjustments should be included by changing just one, or at most 2 rounds of fertiliser, thereby keeping the plan as uniform and simple as possible for the remainder of the year.

Additional P required for low P soils should be front-loaded towards the spring. Using a straight P fertiliser or a compound fertiliser with higher P levels in one of the first two rounds in spring will allow higher P input to factor in some allowance for soil P build-up in addition to just maintenance.

For fields low in K, autumn is a better time to apply additional K for build-up, as it helps avoid the risk of high K in spring affecting Mg uptake. Simple adjustments to apply more K would include slurry in autumn, applying straight K fertiliser (e.g. muriate of potash), or swopping one or 2 of the final rounds of N with an NK fertiliser.

Silage and surplus bales

Finally, in the case of fields cut for surplus bales, the balancing of the P and K offtake removed by cutting can be balanced by slurry using the rates shown in Table 3 either immediately after cutting, or at least at some point over the course of the year.

Plans for making up the forage deficit at the Greenfield Dairy farm

David Fogarty, Farm Manager, Greenfield Dairy Farm, Kilkenny

I'm from Galmoy in Co. Kilkenny. I'm from a non-farming background and have chosen what has been an enjoyable career to date in grass-based dairy farming. I graduated from University College Dublin in 2014 with a First Class Honours degree in Agriculture (Animal and Crop Production). I was unsure of what my ideal career looked like when I graduated so I gained experience in a few different areas of interest over the course of the subsequent 12 months.

During my time at UCD I would've heard quite a bit about New Zealand, its dairy systems, business structures, progression pathways etc. So, in July 2015 I took the leap and went there to figure out a few things for myself. Over the course of the subsequent 2½ years I was lucky enough to have worked on three different farms in Canterbury, brush shoulders with some other top-end Kiwi farmers, explore New Zealand and looking back and without doubt most importantly to me, surround myself with some great like-minded, young dairy farmers from Ireland and the UK that I do my best to keep in continuous contact with. The three farmers/farms that were kind enough to share with me their own individual takes on what low-cost, grass-based dairying looked like were Erik Lenssen, Birchdale Dairies; Alistair and Sharon Rayne, Inisfree and Simon Van Der Heyden, Canterbury Grasslands. To briefly summarise my experience of New Zealand, most of which is relevant in an Irish scenario, you must: 1) run your farm as a business, 2) have a clearly defined farming system with measurable, relevant metrics, 3) maximise pasture grown and utilised through optimum soil fertility, variety selection, grazing management, calving rate and calving date, 4) breed the correct type of cow for 'your system' that'll calve every 365 days for a number of lactations, and finally 6) don't be afraid to share your knowledge or experience with or offer credible opportunities to young people in the industry.

Towards the end of March 2018, I moved back home to Kilkenny and took up my first farm management role at the Greenfield Dairy Farm from late April. Looking to the future, I plan on further expanding my knowledge of people, farm and business management; move into herd ownership; with the ultimate plan being to use cows and grass to help me get a patch of my own.

Background to the Greenfield Dairy Farm

The Greenfield Dairy Project commenced in December 2009, for a 15 year term. Thus it has been in operation for 9 years, with approximately 6 years left to run. The project was established by Teagasc in conjunction with key stakeholders as part of a new milk production programme which had the key objective of providing dairy farms who intend developing new Greenfield dairy operations the necessary skills and technologies to deliver satisfactory financial return to the resources employed. The Greenfield farm was a conversion to dairying from a tillage enterprise with the purpose of investigating if a new dairy enterprise could be established while paying a cost for land, and covering all labour and operating costs, and servicing the capital loan required for set-up by applying the key principles of successful dairy farming. It had an initial target of 250 cows, with this rising over the years to in excess of 300 cows.

Objectives of the Greenfield Dairy Farm

- To provide an industry blueprint in the design and layout of a low cost farm infrastructure setup.
- To test in a large farm scenario technologies that have been developed within a research environment.
- To develop management and labour efficient protocols for the operation of a large dairy unit
- To demonstrate the financial feasibility of converting a 'Greenfield' farm into a profitable dairy farm business

Operating structure of the Greenfield Dairy Farm

The structure of the project is that the farm is operated by a specially established company, Greenfield Dairy Partners (GDP) and Teagasc provides management support to the farm and uses the farm/project for extension purposes. Milk quota was licensed by the DAFM for use in this project. The GDP Ltd shareholders are (1) Glanbia (CM) Limited (2) The Agricultural Trust and (3) Edward and Eamonn Phelan. The Phelans own the land and lease it to the GDP.

1. Grass and Soil Fertility Performance

Table 1 shows the grassland productivity, fertiliser input, soil fertility and winter feed budget for the Greenfield farm for the years 2012 to 2018. The grassland productivity of the farm increased significantly over the period; the poor performance in the early years was accredited to the carry over effects of the long term cropping practiced prior to conversion to grassland. Soil fertility was maintained over the period although it required yearly monitoring. Winter feed requirement has increased since 2012 due to the increased stocking rate each year. Percentage feed bought includes (1) bought in silage (2) meal fed to cows (3) cows wintered annually off farm (60 cows each year since 2015). In 2013 and 2018, there were prolonged periods of severe soil moisture deficits (drought) on the farm due to the lack of rainfall. This is an annual risk to the farm in the summer period. In 2013, approximately 200 tonnes of silage dry matter was purchased to feed during the summer drought we experienced and the following winter. Favourable grass growing conditions in 2017 allowed us to build up a good reserve of silage for the coming winter. That autumn however the herd was restricted due to an outbreak of TB and we had to overwinter more cows than originally planned and we had no surplus of silage for the wet cold spring we experienced in 2018. Extra silage was purchased to feed the herd which was followed by a severe and prolonged drought during the summer of 2018. In all over one third (37%) of the total feed required was bought this year as a mixture of both meal and forage. The system we've operated for the past five years or so relies on purchasing winter forage for around 50-60 of the dry cows each winter from the same farmer. This is approximately 20% of dry cow total winter feed requirement. In addition the in-calf heifers which are being contract reared off-farm return to the Greenfield farm in mid-January and so they spend most of the winter off the farm.

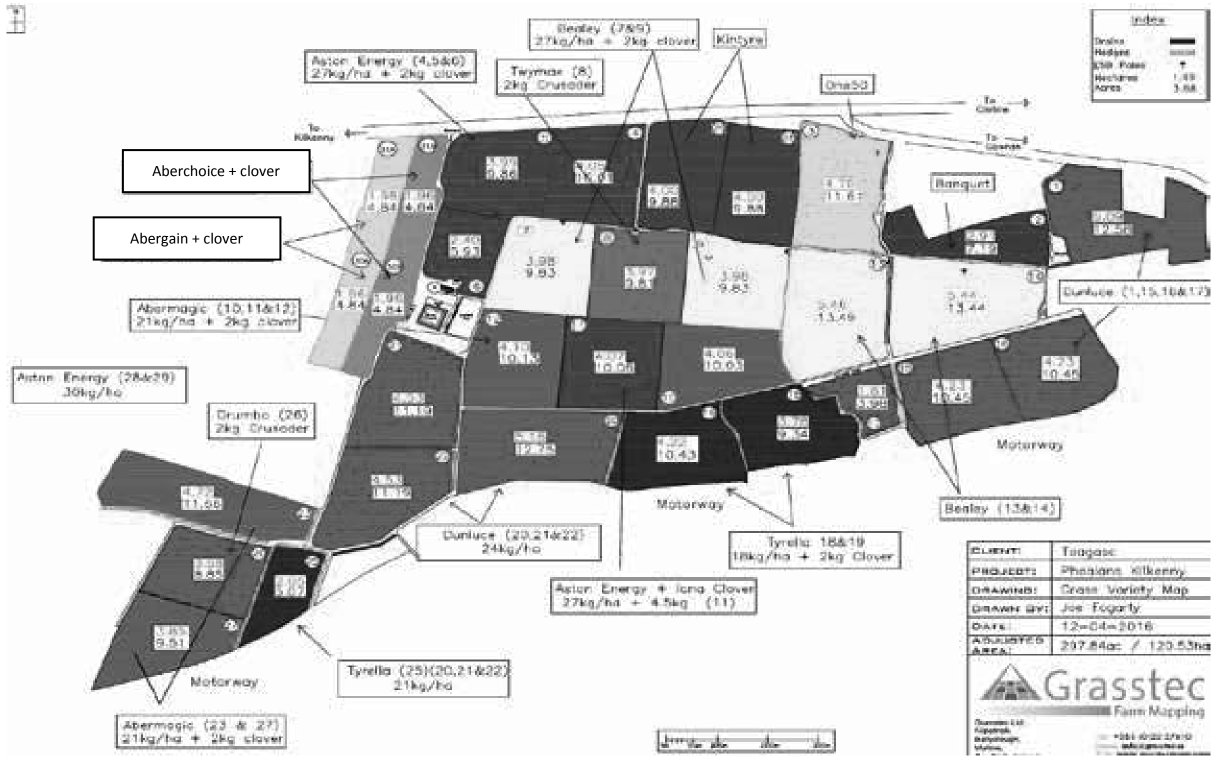


Figure 1. Grass and Clover Cultivars on the Greenfield Dairy Farm.

The 30 paddocks on the farm are set down to one variety of perennial ryegrass each plus white clover (Figure 1). The 12 cultivars are monitored as part of the Monoculture trial on-going at Teagasc, Moorepark.

Soil Fertility

The farm is soil sampled annually and is in nitrate derogation since 2012. The farm has an allowance of 30,000 kg chemical N per year (250kg N/ha/ 120.5ha farmed). Initially, N fertiliser was bulk spread monthly. However this practice has been changed to weekly spreading since 2013. Phosphorous fertiliser allowances have been steadily declining as soil indices improve and it looks likely that the farm will have no P fertiliser allowance in 2019. While Phosphorous is typically spread in the spring, most of the K is applied in the autumn (to reduce the risk of grass tetany) with only a small amount applied in the spring.

Lime and sulphur

To date 650 tonnes of lime have been applied to the Greenfield farm (as detailed in Table 1). Soil testing is carried out annually to monitor changes in soil fertility on what is an intensive farm.

Sulphur is applied from February each year. The farm traditionally receives sulphur in the form of ASN (total annual application detailed in Table 1). As is the dry nature of the soil at the Greenfield farm it is unable to store Sulphur which means spreading Sulphur regularly is essential, particularly in the early part of the grass growing season.

Annual Rainfall

The Geographic nature of the farm location has shown that the average annual rainfall is consistently less than 1,000 mm (Figure 1). The rainfall to the 19th December 2018 was 898 mm (Table 1).

Table 1. Grassland production, fertiliser applications and soil fertility status at the Greenfield Dairy Farm (2012 – 2018).

Year	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
Grass grown (Tonnes DM/ha) [4]	11.8	10.0	13.5	13.9	14.7	15.0	12.0
Est. grass utilised (Tonnes DM/ha)	10.5	9.3	11.5	11.6	11.7	11.3	8.5
Stocking rate (LU/ha)	2.60	2.83	2.72	2.73	2.75	2.90	2.74
Rainfall (mm)	791	746	930	826	693	790	898[5]
Fertilizer application (kg/ha)							
Nitrogen	250	250	250	250	250	248	250
Phosphorus	0	16	19	21	22	16	11
Potassium	34	73	88	70	54	40	77
Sulphur	36	40	32	33	48	46	36
Lime (total tonnes)	0	0	100	195	359	0	0
Soil Fertility							
Phosphorus levels (PPM)	10.1	6.6	7.8	6.2	7.5	7.3	8.0
Potash Levels (PPM)	104.6	121.5	105.5	128.2	153.9	105.8	117.0
pH/Lime Status	6.5	6.5	6.6	6.2	6.1	6.6	6.7

[4] Measured using the PastureBase Ireland programme.

[5] Rainfall measured to 19th December.

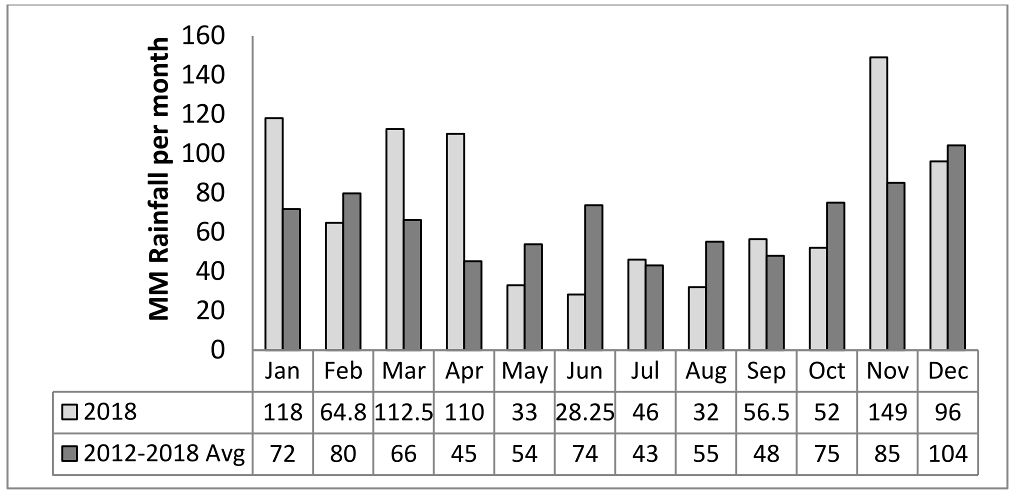


Figure 2. Annual Rainfall on the Greenfield Dairy Farm from 2012-2018[6].

2. Milk Production and Herd Fertility Performance

The data in Table 2 summarise the milk production performance of the herd over the period 2012 to 2018. Milk solids output from the farm increased by 32% over the 6-years to the end of 2017. This was associated with an increase in cow numbers of 18%, increase in milk solid output per cow of 12% and an increase of milk solids output per hectare of 25%. Milk sold decreased in 2018 by 11% per hectare and 6% per cow compared to 2017. This was due to a considerable reduction in the amount of grazed grass (April and the drought period in the summer) in the milking cows' diet and lower cow numbers. A number of cows that were culled in 2018 should have been culled in 2017 which would have had an impact on 2018 milk sales per cow. There were a number of cows that had SCC issues and these were also milked for part of 2018. These were treated and some were culled. Again, this would have had a negative effect on milk production in 2018. Calves were not sold as early as other years and were fed whole milk. Over the period (2012-2018) average fat content increased from 4.54% to 4.94% and milk protein content increased from 3.62% to 3.94%.

[6] To 19th December 2018.

Table 2. Milk production and composition 2012 to 2018.

	2012	2013	2014	2015	2016	2017	2018
Milk delivered (,000 litres)	1,316	1,470	1,413	1,491	1,540	1,615	1,444
Milk solids % (fat + protein)	8.18	8.06	8.34	8.52	8.65	8.65	8.85
Milk solids sold (,000 kg)	111	122	121	131	137	144	129
Milk solids sold kg/ha	982	1,080	1,074	1,090	1,143	1,198	1,071
Cow number	294	320	307	328	331	348	329
Milk Solids sold (kg/cow)	377	381	395	400	414	413	390
Milk sales (litres/cow)	4,478	4,593	4,604	4,545	4,651	4,642	4,388
Concentrate fed kg/cow)	307	620	270	180	240	220	1,000[7]

Table 3 shows the overall herd fertility obtained on the Greenfield farm 2012 to 2018. In September 2018 herd EBI was €147. The actual 6-week calving rate of the herd increased from 69% to 82% over the period. Empty rate has been below 10% on average over the 6-years.

Table 3. Overall Herd Fertility on the Greenfield Dairy Farm 2012-2018

	2012	2013	2014	2015	2016	2017	2018
Date when 50% herd calved	1-Mar	12-Feb	13-Feb	19-Feb	12-Feb	14-Feb	12-Feb
Herd EBI (€)	53	74	91	98	101	113	147
Actual 6 week calving rate (%)	69	71	80	76	81	81	82
Mating start date	16-Apr	24-Apr	24-Apr	22-Apr	22-Apr	24-Apr	1-May
Breeding season length (wks)	12	12	15	17	14	12.5	13
Not in Calf Rate (%)[8]	11	10	10	5	8.5	12.7	8
Replacement Rate (%)	20	36	30	26	22	24	22

3. Solutions/actions taken to manage the drought and the winter forage deficit

Table 4 summarises the focus areas and actions taken by the team at the Greenfield farm to manage the drought of summer 2018 and address the challenge presented by the winter forage deficit.

[7] Estimated to end 2018.

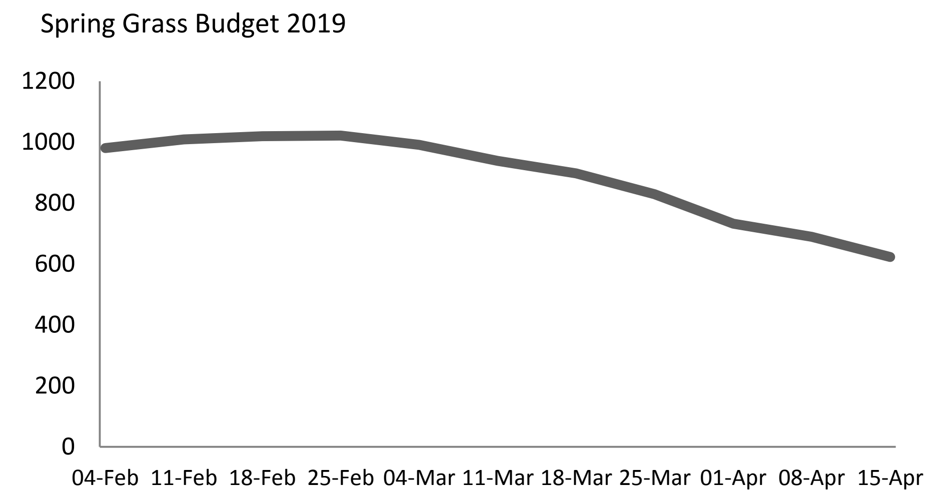
[8] 100% AI since 2012.

Table 4. Actions taken to manage the drought and prepare for Winter 2018/2019.

Focus Areas	**Actions taken**
Moved Start Date of Calving	Mating Start Date delayed by 7 days (24th April - 1st May). Compact calving and shorter gestations have increased feed demand in early February.
Introduced supplement as growth rates slowed in June	Introduced meal and fed good quality silage made on farm
Always had a plan	Walked the farm every 7-10 days and afterwards planned out how we would manage feed supply until the next walk
Grazed Second cut silage ground	Helped build grass for 75 days.
Reduced Stocking Rate	Sold culls and empties early (culls in July/August and empties in September).
Built Grass	When the rain came in Sept, spread Nitrogen and Potash and kept feeding meal and silage to build grass and extend rotation length.
Sourced Winter Feed	Bought silage bales/hay. Talked to the contract rearers about wintering in-calf cows off the Greenfield farm.
Grazing Targets for final rotation	70% farm closed in October and rationed the rest to the 14th Dec.
Closing Cover Target	Closed at 814kg DM/Ha on the 14th Dec.
Wintering	100 dry cows sent for wintering to contract rearers. 177 dry cows wintered on Greenfield farm. 72 in Calf Heifers at contract rearers until mid-January '19.
Spring Grass Budget	A spring grass budget and spring planner prepared based on estimated opening cover, predicted 6 week calving rate and 6 year average growth rates. If the Average Farm Cover drops below 550 Kg DM/ha before the end of March, then supplement will be increased. If the Average Farm Cover is greater than 550 Kg DM/ha then the supplement will be decreased.

Key targets for the farm (see Figure 4) for spring 2019 include:

- We plan to open at an average farm cover of 980 kg DM/ha;
- We have budgeted on feeding 4 kg meal/cow per day from calving until 'Magic Day' – which we *hope* will happen on April 8th;
- We will ensure that the AFC falls no lower than 550 kg DM/ha.



	04-Feb	11-Feb	18-Feb	25-Feb	04-Mar	11-Mar	18-Mar	25-Mar	01-Apr	08-Apr	15-Apr
AFC (kg DM/ha)	980	1009	1019	1021	991	938	897	829	732	689	623

Figure 4: Spring grass budget for spring for Greenfield dairy farm based on an opening cover of 980kg DM/Ha.

4. The future of grass production on the Greenfield farm

As is the nature of grass-based dairying, weather patterns will continue to influence grass growth and utilisation. The farm has survived two extremely cold winters, two drought summers and two higher than normal rainfall winter/springs. The location of the farm and the knowledge gained since start-up have shown that average annual grass grown won't be as consistent as in other regions. However, the fundamentals will remain exactly the same for the remainder of the Greenfield project i.e. high levels of grass utilisation season after season.

Notes:

Notes:

Notes:

Notes:

Irish Grassland Association

DATES FOR YOUR DIARY

Pre-Conference Networking Evening
Charleville Park Hotel
8th January 2019

YARA

Dairy Conference
Charleville Park Hotel
9th January 2019

YARA

Sheep Conference and Farm Walk
Meath
23rd May 2019

MSD Animal Health
Mullinahone Co-op Est. 1893

Beef Conference and Farm Walk
20th June 2019

MSD Animal Health
Mullinahone Co-op Est. 1893

Dairy Summer Tour
23rd July 2019

AIB

Student Conference
October 2019

FBD INSURANCE

Take Control of Your Crop

- Soil sample regularly
- Choose the correct fertilizer
- Calibrate your spreader

YARA

Knowledge grows

@Yara_Ireland

Yara Ireland

yaraireland@yara.com

www.yara.ie