Adaptation Strategies on Ruminant Farms in Extreme Weather Conditions such as 2018

June 2019

Summary

- *Grass DM production declined due to the soil moisture deficit by 3-3.5 t DM/ha on average across farms in 2018, total DM production was 10.8t DM/ha*
- *Better communication and more continual use of grassland data reported from Pasturebase Ireland is required by all sectors of the Agri -industry*
- *Seasonal grass growth variations (positive and negative) are not new, however the Agri- industry needs to react faster to their knock on effects.*
- *A proportion of farmers do not engage with either Teagasc or the Co-ops, a medium needs to be found to reach these farmers (possibly through the Mart network)*

Recommendations

- *Adaptation strategies will mean that farmers both on heavy and dry land will need to have a feed reserve available of 400kg DM per LU, over and above normal winter feed reserves.*
- *Ireland needs to become more self-sufficient in animal fodder supply for the national herd*
- *A national fodder budget survey should be completed each July in Ireland to ensure sufficient feed stocks are available in the country*
- *Teagasc need to continue to promote grassland measurement within Pasturebase Ireland to improve grassland production and utilisation on farms.*
- *Grazing, feed storage and feeding infrastructure needs to be improved to allow for better feed management in extreme weather conditions*
- *Good silage making practices need to be adopted by all livestock farmers*
- *Met Eireann should make more use of the Teagasc MOST grass growth prediction model to forecast weekly grass growth nationally*

Background

Within grassland production, variation exists within and between farms. In many respects the higher the grass performance within the farm, generally the lower the variation in DM production within the farm gate. Every farm situation is unique with varying soil types, local climatic conditions, stocking rates, grazing days and farmer management capabilities but grass production is currently limiting on most Irish farms, with huge scope to increase grass production. Ireland has increased the dairy herd in the past number of years, generally with the expansion of milk production. Winter feed requirements have grown rapidly on some farms, on such farms the realisation that increased feed reserves is required to overcome deficits in grass supply across the season.

On many farms especially in most marginalised soil type there has always been a tendency to conserve extra silage DM, extremes weather events such as the high rainfall of 2009 and the poor spring of 2013 have solidified farmers minds regarding the extremes of some years weather. The lead into 2018, was highlighted by excessive rainfall in the western half of the country from mid September, which meant that farmers to house stock earlier than normal, these weather events are summarised in Table 1. In the main there were three weather events in the 2017/2018, excessive autumn rainfall, storm/blizzard conditions and a major drought in mid 2018. So it is not really correct to isolate 2018 on its own, some of the major impacts of 2018, their foundations were laid in autumn 2017. The economic impacts of 2018 with regard to feed costs left a heavy burden on some farms, analysis of profit monitor data (Ramsbottom et al. 2019) showed that the increased level of concentrate feeding in 2018, resulted in €650/ha lower farm profit for dairy farmers. When feed is in scarce supply, the feed price escalates, this is what happened in 2018. In many cases farmers would have been better off to sell stock rather than retain them, due to the costs of average feeds.

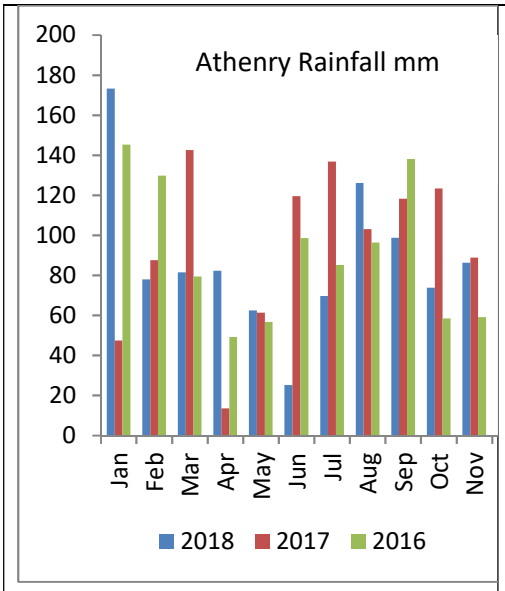
Table 1. Weather effects and effects on farm management decisions in Autumn 2017 and 2018

Date	Weather Event	Impacts
September- October 2017	Excessive September rainfall	Housing of livestock, constrained harvesting of silage, low winter feed availability in Northwest and Midlands
March/April 2018	Storm Ophelia - Snow and lower temperatures	Two weeks low/no growth and storm damage effects. Subdued spring grass growth and grazing utilisation
June – August 2018	Low rainfall, high daily temperatures	Subdued grass growth for 6 weeks across country, no second cut silage harvested. Herds supplemented >60% of diet with concentrate and silage etc. Major feed cost, little animal response

The challenge for farmers will differ depending on the year and the region of the country and individual farmer capability and ability to forecast forward fodder issues.
In some regions concentrate, grass and maize silage is expensive due to demographic supply and distance. The technology today for harvesting grass silage was never better, the technology to harvest round bale silage is also world leading, the contractor network is extensive, however the timing of silage conservation does need some work at farm level.
In particular the continued delay of first cut silage into early and mid June has huge consequences on the success of capturing adequate quantities of silage in a second silage harvest.
In autumn 2017, the northwest had very high rainfall, grazing ceased early and silage conservation was delayed and in some cases paddocks weren't harvested. Farmers housed stock early in September, this depleted silage stocks. Silage had to be moved from the southern half of the country to this region to alleviate the fodder shortage.

In Spring 2018, a severe weather event, Storm Ophelia – a major snow storm and reduced soil temperatures caused delayed spring growth. But within this period ESB power outages, damage to winter feeding facilities made the husbandry of livestock really difficult. In total spring grass growth was reduced by 500kg DM/ha (from January to April 1). The six month period from September 2017 to April 2018 really challenged the livestock sector regarding having sufficient feed stock available. This was further compounded by reduced grass growth in 2018, with upwards of 3t DM/ha lost because of drought.
This document will discuss and recommend where adjustment and improvements need to be made to overcome the same issues that affected the livestock sector in 2018.

Variation in Rainfall & Soil Moisture Deficits
The annual rainfall for Athenry, Moorepark (Fermoy), Mulingar, Johnstown Castle and Oakpark from 2016 -2018 is shown in Figure 1.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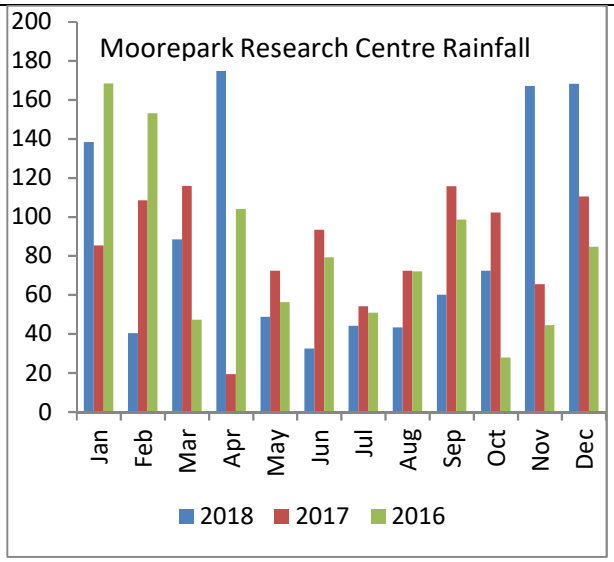
Moorepark Research Centre Rainfall
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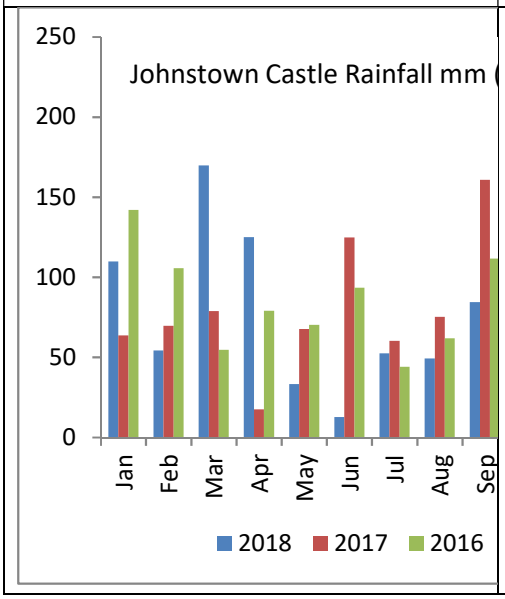
Johnstown Castle Rainfall mm (
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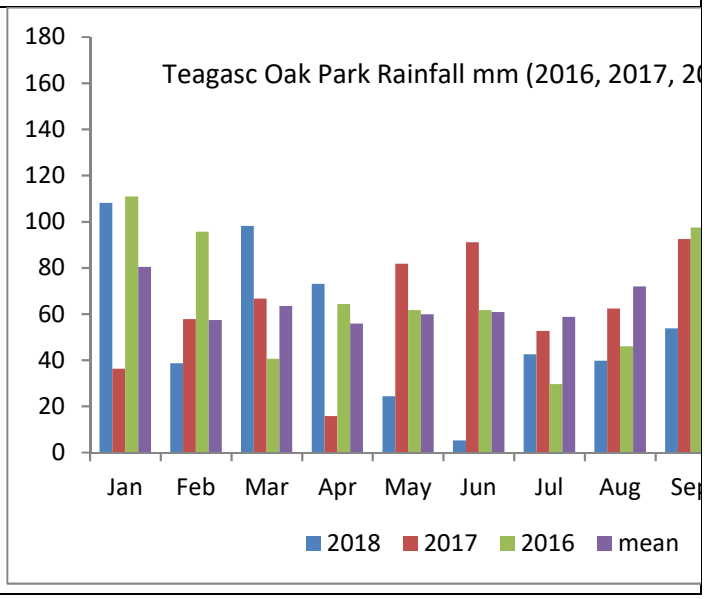
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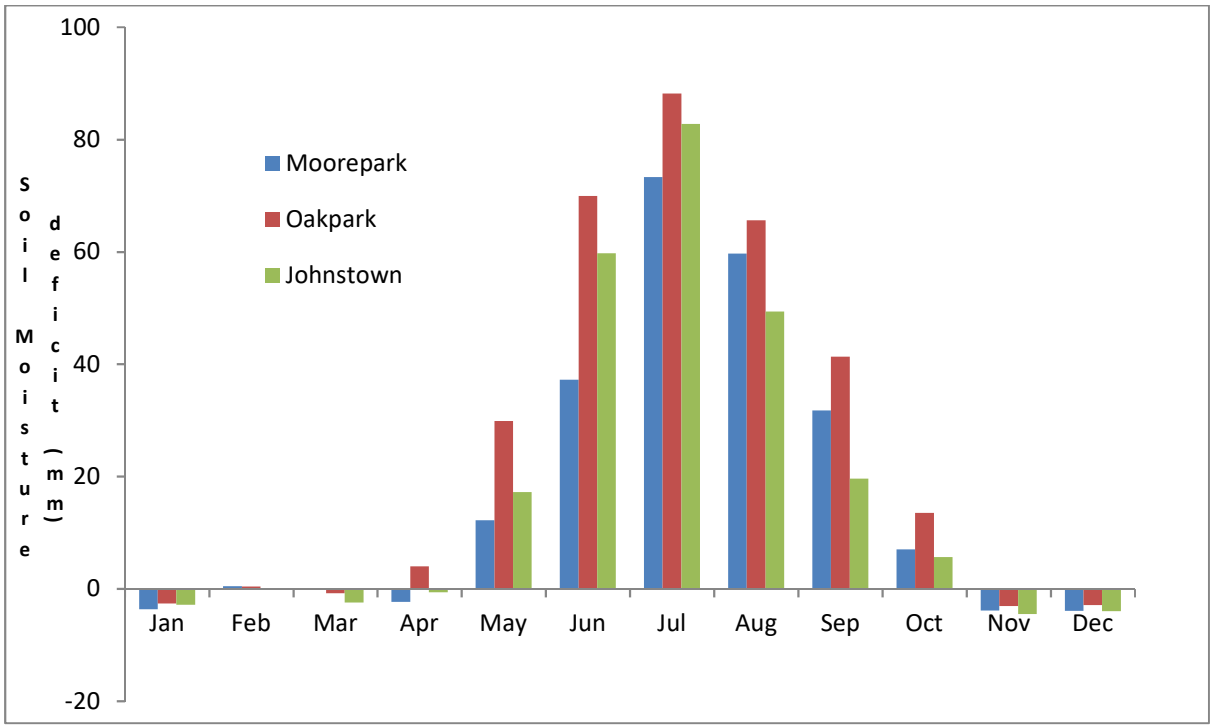
Figure 2 shows the soil moisture deficit (mm), the peak moisture deficits took place in July on all three sites. These soil deficits were associated with very high daily air temperatures and low rainfall levels, as illustrated in Figure1. Oakpark had the highest peak moisture deficit and it prolonged for the longest time period into September.

Figure 2. Soil moisture deficit (mm) for Moorepark, Oakpark and Johnstown Castle in 2018



Grass Dry Matter Production Trends

Figure 3 shows the weekly national grass growth profile for the last three years. Overall there was a loss in of 3-3.5 t DM/ha in 2018 on farms compared to the excellent grass growing year in 2017. Individually some farms lost 6t DM/ha, approximately 0.5t DM/ha of this loss was from a poor spring but the majority was from the dry mid-summer drought. In periods of grass shortage high levels of supplementation were fed, with little other choice available to farmers.

Figure 3. National weekly grass growth from PastureBase Ireland Farms (2016-2018).

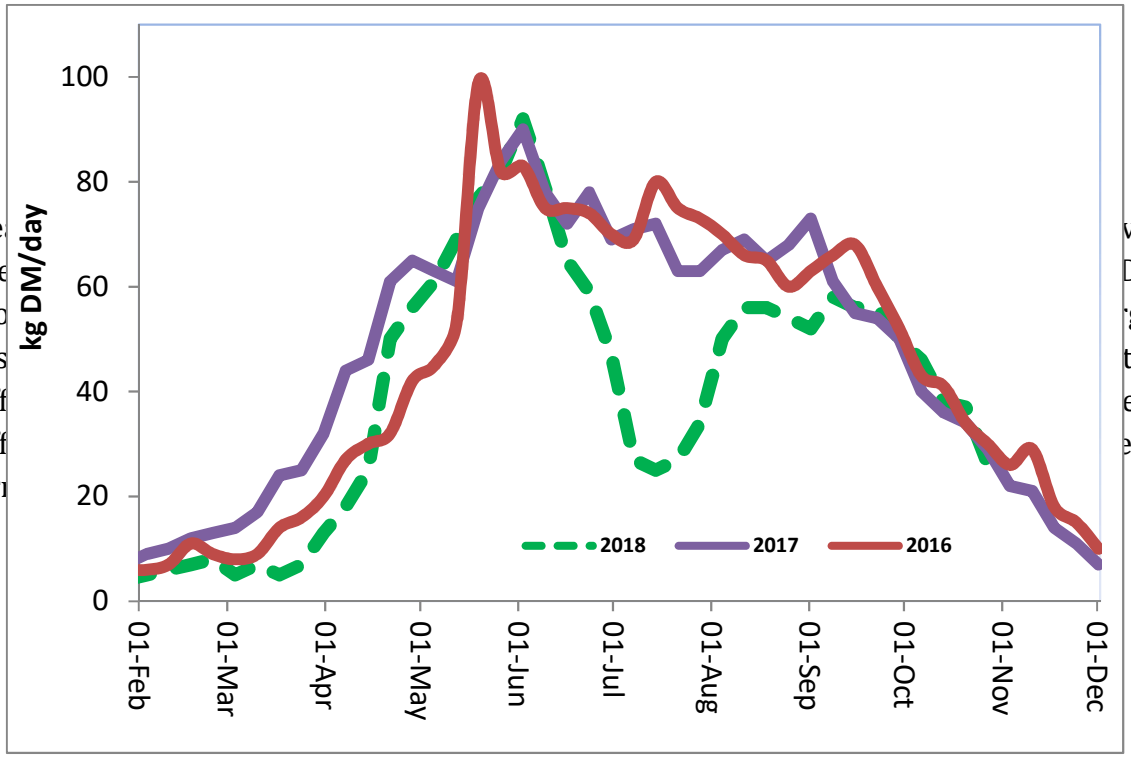


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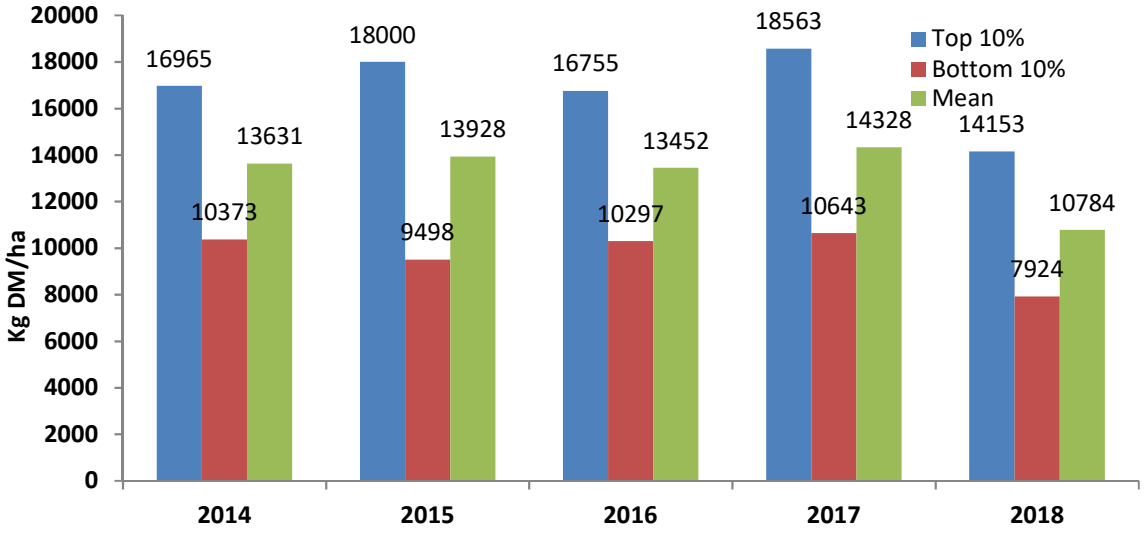
Figure 4. Comparison of National average dairy farm DM production from 2014- 2018 of farms participating in Pasturebase Ireland completing >30 measurements per year



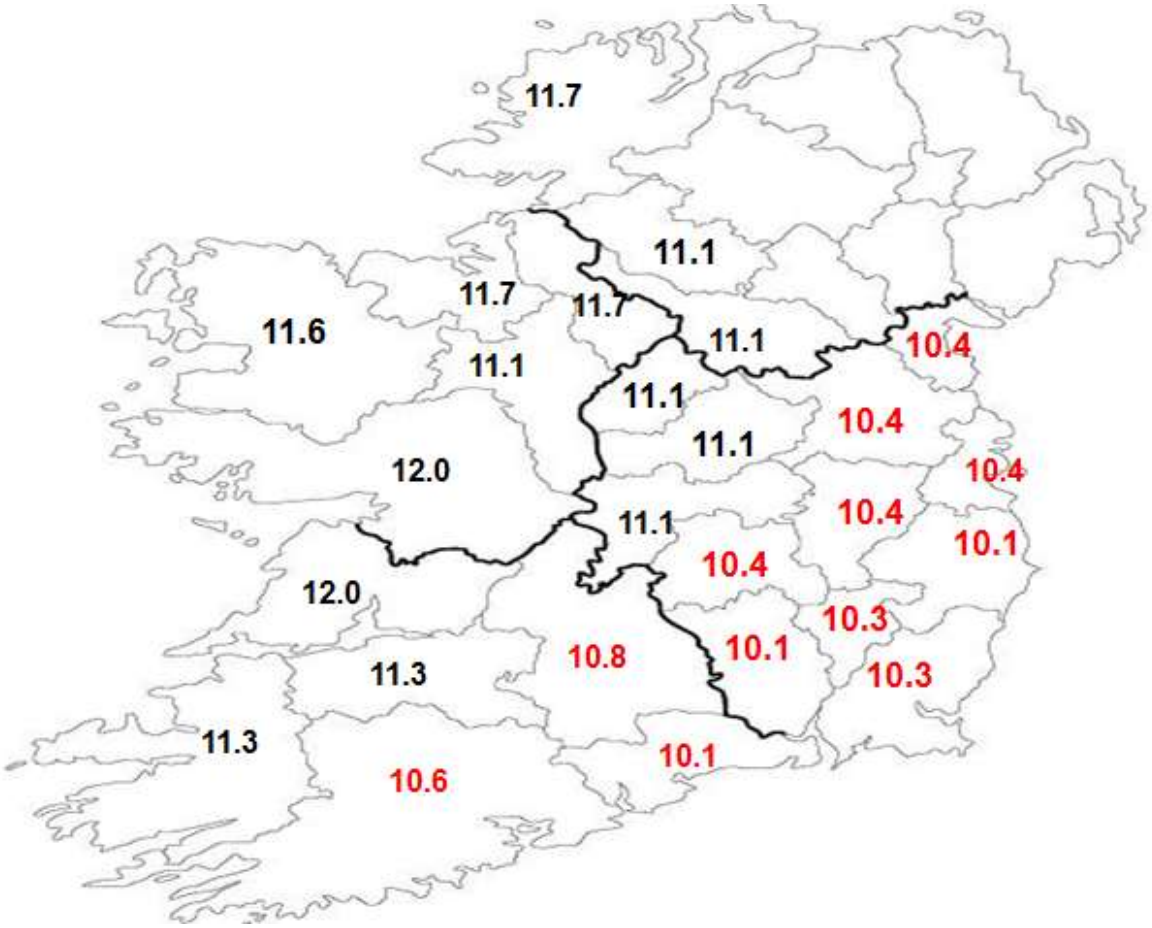


Figure 5. Grass growth profile for all countries in Ireland in 2018

The national grass growth profile for the country for 2018 is shown in Figure 5, the county with total DM production <11t DM/ha is denoted in Red and those with > 11 t DM/ha is denoted in black. Cork, Waterford, Tipperary, Wexford, Carlow, Kilkenny, Laois, Wicklow, Dublin, Kildare, and Meath all had very poor grass production, in these counties a total of 911,000 dairy cows and 350,000 suckler cows are farmed, which equates to nearly half the total cow population of the country.

Both Figures 5a and 5b show the constitution of the average grass output on PBI over 2017 and 2018. There is a number of interesting aspects to both graphs. Firstly the range in DM production was from 10 to 18t DM/ha in 2017, whereas in 2018, this range declined to 6 to 16t DM/ha. From Figure 4, it is clear the geographic location of this range moved from south in 2017 to the west in 2018. Another aspect of both graphs, which is worth noting is that in 2017, 30% of the farmers measuring in PBI recorded 14 t DM/ha, where as in 2018, 25% of farmers recorded 10t DM/ha. Only 10% of the population of farmers recorded >14t DM/ha in 2018, wheres in 2017, 10% of the population were growing >17t DM/ha. Since the introduction of PBI in 2013, on farm grass production has increased in each year, 2017 average grass production was 14.4t DM/ha, 2018 has the lowest grass production year in the past five years.

From the Moorepark FAO, a grass growth study which has been measured since 1982, both 1995 and 2018 were the lowest grass producing years.

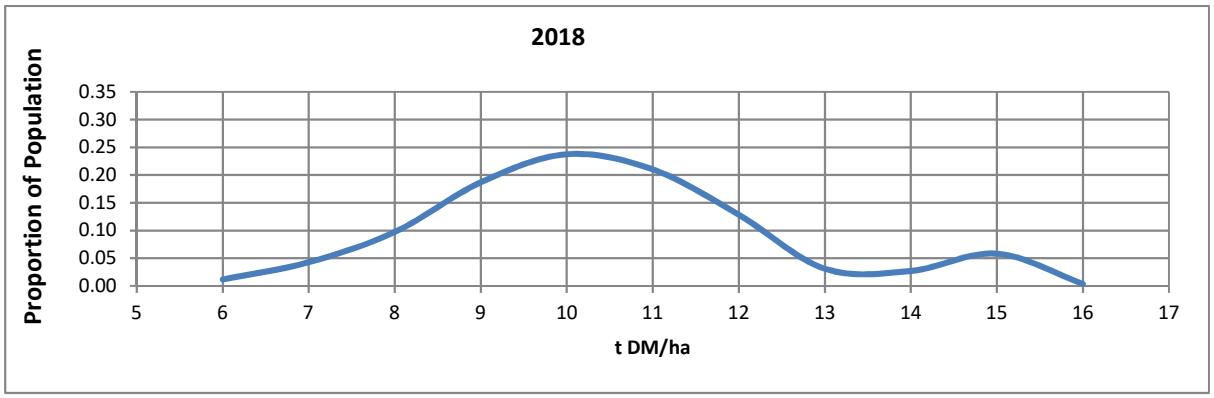


Figure 6a. Different proportions of farmers on Pasturebase Ireland with varying grass growth thresholds for 2018

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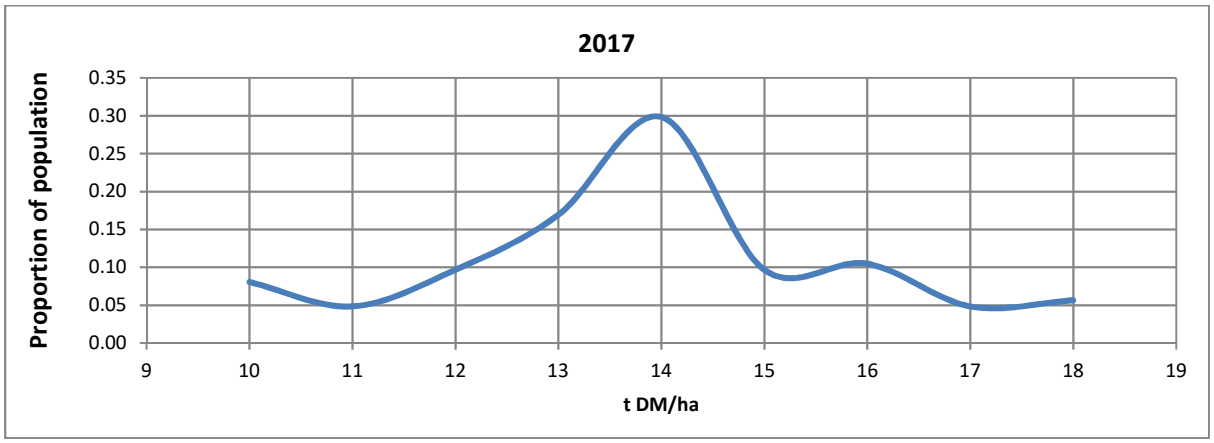


Figure 6b. Different proportions of farmers on Pasturebase Ireland with varying grass growth thresholds for 2017

LESSONS LEARNT FROM RECENT FODDER SHORTAGES

Adverse weather has always been understood as more an inevitability than a risk in farming. Nonetheless each recurrence of prolonged poor weather brings acute challenges to workload, grazing management, feed supplies and costs to farming. There is now acute awareness that increased fodder reserves are required on farms, especially where animal numbers have increased. This is one key finding of the drought of 2018. Awareness of this must move across the Agri industry. A realism for farmers now that feed costs rise enormously especially when in short supply so it definitely much better to have this supply available in your own yard and not be dependent on bought in feed.

The need for good grazing infrastructure, responsive pastures and appropriate housing and feeding facilities are clear strategies to improve resilience. For those farmers who find themselves continually short of winter feed, they will have to reanalyse their strategies regarding the longterm aspect of this approach. The need to have possibly local arrangements regarding securing winter feed is going to be important for the future for some farmers.

1. DEFINING OPTIMUM STOCKING RATE

Stocking rate (SR), defined as livestock units (LU) per unit area of land (e.g. cows per hectare), is a primary determinant of pasture utilisation, feed supplement input, milk yield per cow and milk output per ha in grass-based dairy systems. It is a significant driver of profitability so defining the farm-specific optimum is a vital management decision (1). The objective is to achieve a stocking rate which maximises revenue over feed input costs, taking cognisance of issues like labour input, infrastructure and environmental impact. Optimal SR should deliver high productivity per hectare while achieving forage security relative to the long-term average annual pasture production. To build resilience to significant weather-induced pasture growth deficits, a further reserve of conserved forage must be incorporated into the system.

For a given level of annual pasture growth, milk output and feed input responses to stocking rate changes are typically non-linear; responses vary depending on relative feed supply and demand (2). Where initial stocking rate is low and pasture supply is not limiting, milk output responses to higher SR are positive for little change in purchased feed. As SR increases however, feed demand begins to exceed pasture supply, accelerating the requirement for purchased feed and reducing the potential margins on additional milk. This is an important consideration for farm planning during an expansion phase, and is a separate but related issue to building contingency for weather-related feed deficits.

Calculating stocking rate as simply livestock units (LU) per ha has obvious limitations as a management metric, because it takes no account of variation in feed supply (annual pasture growth per ha) or demand (feed intake per cow). The situation is further complicated where dairy herd expansion on a limited milking platform results in a progressive displacement of silage production and greater dependence on external land blocks to balance silage budgets. This situation is illustrated in Table 2.

Table 2. Effect of grazing stocking rate on feed budget per cow

	Milking platform[1] stocking rate (cows/ha)						
Feed t DM per cow	**2.2**	**2.5**	**2.8**	**3.1**	**3.4**	**3.8**	**4.2**
	15.5t DM annual pasture growth						
Silage made kg DM	2000	1490	1100	790	540	179	140
Silage balance[2] kg DM	598	82	-306	-658	-1023	-1414	-1538
Concentrate kg	670	720	810	950	1041	1159	1320
	10.5t DM annual pasture growth						
Silage made kg DM	830	505	285	140	46	0	0
Silage balance kg DM	-584	-932	-1267	-1430	-1593	-1737	-1863
Concentrate kg	830	1035	1230	1402	1550	1737	1820

[1] Land area available for grazing accessible from the milking facility

[2] Net balance between total conserved forage demand and total forage conserved from milking platform area

Here, annual feed budgets (kg DM per cow) are presented for different milking platform SR at two levels of pasture growth (15.5t DM per ha industry target and 10.5 t DM per ha industry average, approximately). It is clear that as stocking rates are increased beyond pasture growth capacity, there is a marked shift toward reliance on external feed sources. Clearly, the SR at which this occurs is depends on annual pasture production. This highlights that it is *overstocked* farms (relative to growth potential), rather than highly stocked farms, that carry greatest risk of feed deficits year-to-year.

As herds expand in circumstances of limited grazing area there may develop a greater disparity between milking platform SR and whole-farm SR (3). This is particularly the case where external land is secured on short-term rental arrangements, which can prove an impediment to investment in pasture renewal and soil fertility. Nonetheless, a useful guideline is that a typical dairy cow fed 0.5 t concentrate annually requires at least 5.5 tonnes DM grass grown to meet total forage (grass plus silage) demand. Mean (2014-17) annual tonnage recorded by dairy farms on PastureBase Ireland was 13.9 t DM/ha, capable of supporting 2.52 LU per farm ha. The bottom 10% of farms recorded 10.2 t DM/ha growth, or a potential farm SR of approximately 1.80 LU/ha. Stocking the farm in excess of 5-year average growth capacity creates reliance on bought-in feed, even before allowance is made for adverse weather effects. This is further underlined by Table 3, which details whole-farm stocking rate capacity relative to pasture growth and basal concentrate supplement levels. Thus generalised recommendations on optimal SR without reference to pasture growth should be avoided.

Table 3. Sustainable stocking rates for a range of pasture growth and supplement levels

	Pasture grown, t			
t Concentrate DM/cow	10	12	14	16
0.00	1.5	2.0	2.3	2.6
0.25	1.7	2.1	2.4	2.8
0.50	1.8	2.2	2.5	3.0
0.75	1.9	2.3	2.7	3.1
1.00	2.0	2.4	2.9	3.2
1.25	2.1	2.5	3.0	3.4
1.50	2.2	2.6	3.1	3.5

2. ASSESSING AND MANAGING FODDER STOCKS ON DAIRY FARMS

Calculating silage requirement

Preventing a fodder shortage requires forward planning and calculation of how much fodder is needed for the winter period. When constructing a winter feed plan there are a number of items to consider. Firstly, we must determine the amount and quality of silage required on the farm. Typically animals with the greatest level of performance require the highest quality feed (72-74 DMD for young stock and milking cows). Silage required can be estimated from stock numbers, the expected duration of the winter and the dry matter (DM) intake per animal, as shown in Table 2. Secondly, our aim is to calculate how much herbage needs to be harvested to produce the required yield, as shown in Figure 1. Mark out this area on a farm map and have a planned cutting date. Any remaining silage production can be managed to produce dry cow silage (68 DMD). If the silage cannot be produced from a single cut, there is a need to calculate an area required for further harvesting i.e. a second cut.

Measuring fodder stocks

Measuring fodder stocks in situ on farm is important to allow for correct assessment and management of supply. Typically silage is measured in tonnes fresh weight before being converted to DM. To calculate the tonnage of a silage pit, multiply the length by breadth by height to get volume in m^3. The volume is then divided by 1.35 to give the tonnes equivalent at 22% DM. Obviously, with modern ensiling practises, DM targets are greater than 22% so adjustments can be made for density in drier silages, i.e. for 28% DM silage divide by 1.5 instead of 1.35 to give the tonnes of silage available. Silage bale weights have increased over the past decade. Recent appraisal of bale weights would indicate that silage bales are 800-900 kg fwt or 200 to 260 kg DM. A 220 kg DM bale is equivalent to 1 tonne of pit silage at 22% DM. For example a single bale will feed 20 dry cows for a day. The conversion factors used above are indicative only. This is a lack of accurate information on silage densities, bale weights etc.

The length of winter varies from year to year but a normal winter lasts between 100 and 180 days depending on geographic location and soil type. This is difficult to predict prior to the onset of winter. Local knowledge should be used when deciding upon the suitable amount of silage required. Regardless of location, a feed reserve of 400 kg DM per cow should be targeted on all dairy farms.

A new version of a feed budget sheet is to be included in PastureBase Ireland for use for calculating feed requirements on farm. The new version will allow for greater precision and flexibility when calculating fodder requirement. This will help farmers to plan for winter feeding period while allowing Teagasc to compile a data set of fodder budgets on farm level each year.

Feed Budgeting Recommendations

It is recommended that:

1. It is recommended that all farmers do a fodder budget after 1st cut silage is harvested and ensiled. This will allow farmers to make in+formed decisions around closing up for 2nd cut but also to examine off farm options where extra fodder may be needed.
2. Research is required to establish a set of standard conversion factors for estimating silage stocks for various feeds.
3. A fodder budgeting task should be incorporated into future Knowledge Transfer discussion group programmes.
4. It is recommended that a standardised fodder budgeting sheet is developed and that deficits needs to be more clearly defined in terms of weeks short rather than a % deficit.

3. BUILDING FORAGE RESERVES

Optimising SR creates a long-term balance between forage utilisation and controlling feed cost. A separate provision is needed to insulate against poor grass growth and field conditions within year. Farm location characteristics i.e. soil type, rainfall, growing season length, and district-level enterprise mix (e.g. tillage, low grazing intensity farms) will determine the scale and nature of the solution for individual farms.

It is important to establish a working estimate of the scale of forage reserve required. Taking 2018 as an example, the cumulative effect of weather events was a grass growth reduction of almost 3.0 t DM per ha in the worst affected regions (South, South East). Annual deficits in other regions varied to around 1t DM per ha (Midlands, North, North West). The range in scale of deficits arose as a combination of regionally varying adverse autumn conditions, poor ground condition in spring, and subsequent summer drought.

National pasture growth and utilisation data from previous 'atypical weather' years is relatively limited, nonetheless data for a Teagasc Curtin's farm, a typical free- draining soil type, indicates year-on-year reductions of up to 2t DM per ha for 1995, 2002, 2009 and 2012 (M O'Donovan, personal corr.). At a contrasting heavy-soil site, Teagasc Ballyhaise, the most severe impact of weather occurs with high rainfall during the growing season, and has resulted in annual reductions of 2.5t DM per ha (11.3t DM vs. 13.8t DM per ha long term average) whereas favourable weather conditions can return annual growths of up to 15.5t DM per ha (D Patton, personal corr.).

Taken these data in the round, and factoring in stocking rate, previous adverse weather events have resulted in deficits of approximately 1 t DM/cow. This is instructive as to potential scale of reserves required for future events. A practical guideline would be to carry at least 50-80% of this figure (500-800 kg DM/cow) as feed surplus above the normal stocks needed to balance the system.

This reserve can be built up over time, using a mix of surpluses from higher-than average growth years and purchased reserves. The scale of reserve may vary somewhat depending on the degree of risk per farm; however a realistic minimum should be established and maintained.

A key benefit of maintaining an adequate forage reserve is that the product options for supplementing diets are much increased. Where the daily deficit is <10% on a DM basis, low fibre (NDF) concentrate products, based on native cereal and protein sources, can be readily used. On the other hand, larger proportional deficits necessitate the inclusion of high fibre by-product feeds to meet nutritional standards (4). Much of this product type is imported which has potential implications for sustainability of the national feed inventory.

Increasing forage grown per ha currently farmed is usually the cheapest means of building forage reserves; this is a strategic priority. While national data indicates some increase in the proportion of area farmed at optimal pH and nutrient status, there remains significant scope to improve annual forage output per ha before alternative sources are considered.
Yield variation has a very significant effect on unit cost of purchased feed (Table 4).

Therefore where single-cut crops are purchased, the preference is to trade on a cost per t DM yield basis rather than cost per ha. In practice this can be difficult to achieve in a spot-trading situation.

Table 4. Wholecrop silage yield and cost per ha versus feed cost per tDM

Field cost per ha	Yield t DM per ha	Feed cost per t DM
€1970 (€800/acre)	12.5	€158
€2470 (€1000/acre)		€198
€1970 (€800/acre)	9.5	€207
€2470 (€1000/acre)		€260

The relative value of purchased forage options (grass silage, whole-crop cereal silage and maize silage) can be calculated per kg DM relative to standard energy (barley) and protein (soybean meal) sources. (http://interactive.teagasc.ie/Open/FeedStuffs). Forage market values should also be adjusted to account for potential losses (5% approximately). Of course, severe short-term deficits drive market cost of forages in excess of nutrient (energy and protein) value due to the functional fibre (NDF) requirements in ruminant diets (4). To counter this effect, it is important that farms in a deficit scenario seek to replenish feed reserves during favourable crop growth years. This has the dual benefit of potentially increasing crop quality as well as reducing cost per t DM.

Where livestock farms are optimally stocked relative to long term average pasture production, consideration can be given to sourcing a proportion of forage reserves from external sources. This may be from tillage farms or less intensive livestock farms depending on local conditions and availability. It is a relatively straightforward proposition to purchase surplus grass from less intensive grassland farms, provided clear terms of trade are established from the outset.

The situation with to regard tillage farms requires more forward planning given the commitment to cropping choice and costs for the grower, and the risks associated with yield variation for the purchaser. It is advised that contracts specifying these conditions and accepted contingencies be established in advance. In terms of tradable crop choice, the guideline advantages and disadvantages for the principal options are summarised in Table 3. The full implications for each crop option should be considered by grower and purchaser in advance of agreeing to a contract cropping arrangement.

Table 5. Benefits and risks for contract crop options grown by tillage farms

	Advantages	**Disadvantages**
Maize Silage	High yield potential High animal performance Crop rotation option	Yield variability Cost per ha
Wholecrop cereal silage	Potential feed quality Flexible harvest options	Cost per tonne DM at low yield Variability in feed quality
Harvested beet	High yield potential Excellent quality feed	Handling and storage Limited utility as fibre source
Contract grass silage	Wide market Crop rotation option	Multiple harvests per year Managing late season grazing
In-situ brassicas	Break crop Cost of establishment	In-situ grazing in winter Yield variation

Feed quality (energy, protein, and digestibility) varies greatly within crop type (6); minimum criteria should be detailed in contracts and crop management adjusted to meet these standards. Forage reserves by definition will be fed to fill pasture deficits. These deficits will largely occur during periods where stocks are expected to be performing at a high level of milk production or weight gain. Therefore, 100% of reserves should be of high feed quality, equivalent to 72% DMD grass silage or higher.

Establishing feed reserves can require a significant cash outlay. At recommended volumes and a moderate forage unit cost of costs of €160-180/t DM, a standard dairy herd would need to invest €80-€140 per cow for no increase in milk revenue. However unlike purchased feed that is utilised within-year, the reserve is retained as stock inventory and so is largely profit-neutral. The cost of building a feed reserve highlights a need to closely examine the economics of increasing herd scale based on conserved forage and concentrates.

4. SILAGE MAKING PRACTICES

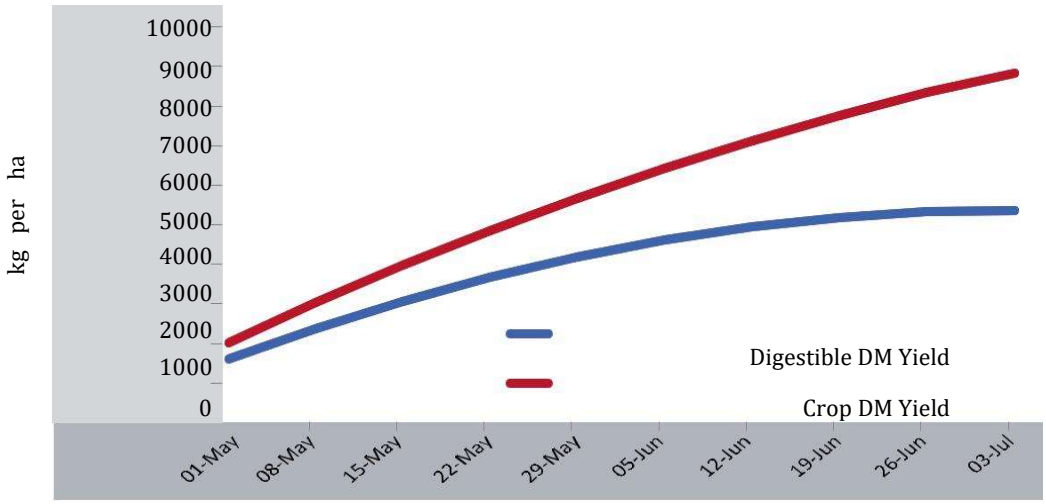
Timing of Silage-Quantity vs Quality

High quality grass silage is a combination of having high grass digestibility with correct harvesting and ensiling management. Firstly, the timing of silage harvesting has a key impact on quality. A high quality sward will grow rapidly during April and May, and should reach a yield of 5000 kg DM ha by mid to late May. Where grass has been grazed in the spring, the target should still be to harvest by the 1st June as grass quality falls rapidly beyond this point. To achieve this, it is important to have first fertiliser applied by mid-March plus a balancing application in early April where required to ensure adequate interval.

Delaying harvesting date will allow for the grass plant to mature, increasing the level of indigestible material. On many dairy farms, first cut silage is ensiled as pit silage with bale silage making up the subsequent cuts. Silage targeted for ad lib feeding of dry cows should be 68 to 70 DMD to meet requirements. Silage for young stock and lactating cows should be 72 DMD+. Silage below these quality parameters will result in increased concentrate requirement or reduced performance.

Another consequence of delaying first cut until mid/late June is that second cut will not be harvested until mid-August. The delayed harvest results in poor regrowth so there is very little opportunity to grow additional silage or to graze in September which limits total annual herbage grown. Where first cuts are harvested in May, there is sufficient time to get a second cut by mid/end of July. This will allow for an additional grazing in September and is crucial to allow the farm to reach target peak farm cover, which will help prolong the autumn grazing period.

Figure 7. Effect of harvest date on silage quality



Sealing the silage pit

Ensiling is an anaerobic process involving lactic acid bacteria, which as they multiply convert turn sugars into lactic acid, which results in a drop in silage pH. Failure to create an airtight seal will result in losses in feed quantity and quality due to butyric acid fermentation. To minimise losses, at least 2 sheets of 0.125mm (500 gauge) polythene should be used when coving a pit. Additional covers can be used to reduce risk spoilage further. In walled silage pits, the walls need to be covered with plastic to ensure airtight seal is achieved. Covers are then folded across the top to seal the top. Tyres should be spread evenly (edge to edge) to weigh down the top of the pit. Avoid tires with exposed wire as wire is likely puncture the cover or, if ingested, cause hardware disease in livestock. The bottom edge of the silage pit needs a continuous seal, so use sandbags, sand, lime etc. to weigh down the cover. For unwalled silos, silage covers need to be checked after 7 to 10 days to retighten the cover after the settling process.

At least four layers of silage wrap are required for bales. Using six layers should be used for bales planned for extended storage duration or for bales that will be handled multiple times. Silage bales should be preferably be stored standing on end. Bales can be stacked on the rounded side up to three high but it is not advisable if DM is less than 35%. Any effluent produced should be collected under the Nitrates regulations

Harvesting in Difficult Conditions

In a typical year there will be periods during the summer where the weather is not suitable for wilting grass. When harvesting in wet conditions it can be difficult to ensile grass effectively. Firstly sugar content in grass will be lower as sugar content is directly related to solar radiation. Even so the aim should be to cut grass in the afternoon when sugar content is highest. Grass with a large proportion of stem will generally have adequate sugar levels, while leafy grass will be lower. Check grass for sugars before harvesting if in doubt. Once sugar content is above 3%, there is adequate sugar for ensiling grass. Where sugars are between 2-3%, there is need to examine the nitrates and weather conditions. Wilting helps increase concentration of sugar in the grass sap. Where wilting is not possible, an additive could help improve fermentation. Suitable additives in poor weather are molasses, acid or an absorbent. Try to avoid soil contamination as much as possible. First cuts should not be delayed for an extended period of time as the benefits of waiting for better conditions can be outweighed by the declining silage quality and lower yield potential of a late second cut.

Silage on out-farms

With milking platforms currently be used to maximise grass production for grazing cows, there is a greater demand coming on out-farms to supply winter feed. Typically out-farms would have less intensive management resulting in poorer soil fertility and sward type. As a result sward productivity will be lower than expected at the recommended fertiliser application levels. The consequence is that harvest is delayed and quality will be lower

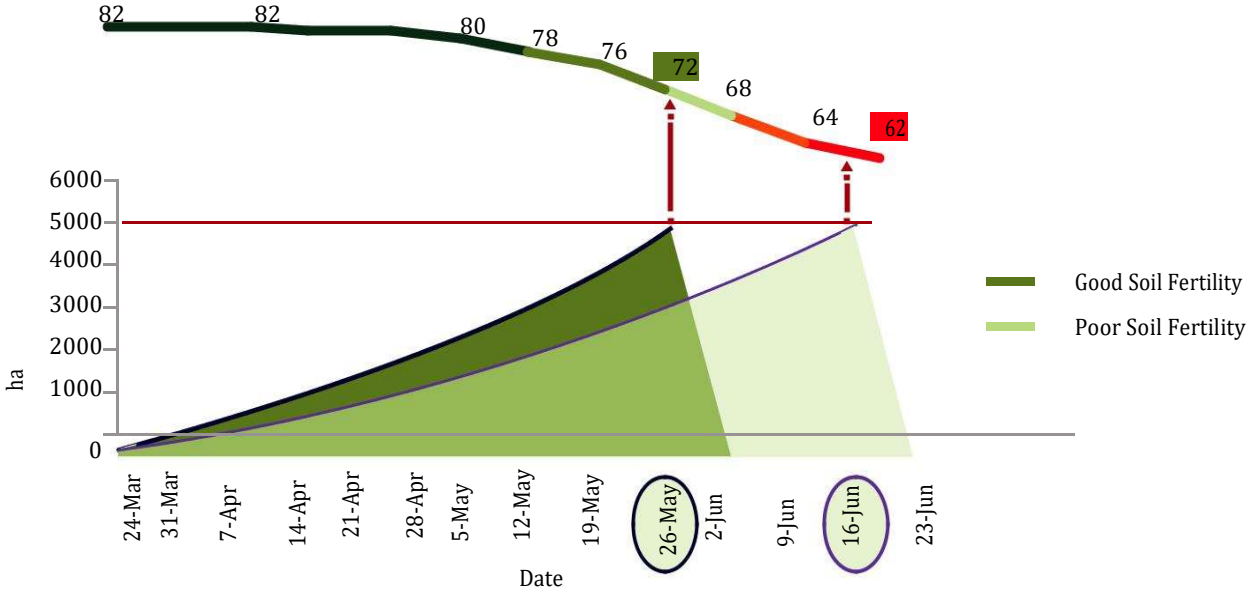
than required. Where silage is been harvested on leased land or Teagasc have a cost of silage calculator developed to allow comparison between concentrates with grass silage depending on harvesting type and land use. This can be used to help decide weather is it cheaper to purchase silage or concentrate in addition to calculating what purchasing a crop of silage is worth. Farmers need to consider the structure of leases on rented land, particularly as the % of rented ground on the whole farm increases.

Soil Fertility

A review of soil sample results over 2017 and 2018 analysed by Teagasc indicates that soil fertility levels on Irish farms may be turning a corner, with some positive signs of overall improvement. Across all farm enterprises the only soil fertility indicator showing significant signs of improvement was soil pH with 54% of soils having optimum pH levels. Examining soil P and K levels across all farming systems, just 38%
and 45% of soil samples, respectively, had sufficient P and K for optimal grass and crop production (≥ index 3).

Improving soil fertility is a 4-5 year project and requires considerable investment, consequently there is an unwillingness to invest in improving in soil fertility on this land. Firstly farmers should follow the advice outlined on their Nutrient Management Plan when deciding on a fertiliser application. As silage has a large nutrient off take, it can be very difficult to build soil fertility on land in continuous silage production. Poorly performing soils on rented blocks of land will limit overall stocking rate capacity of the farm and increase the risk of inadequate conserved forage stocks.

Figure 8. Effect of soil fertility on silage quality



Recommendations

It is recommended that:

1. A greater emphasis should be placed on harvesting high quality first cut silage on all farms in May, with the majority of the first cut complete where possible
2. The correct covering procedures of silage pits and management of feed reserves should be included in discussion group material
3. Use NMP to address soil fertility issues on farm to increase nitrogen use efficiency of fertilisers for land assigned to silage production

5. **INFRASTRUCTURE**

Grazing Infrastructure

The guiding principal of good grassland farm infrastructures is that it's safe, produces quality product from healthy animals using management practices that are sustainable from an animal welfare, labour efficient, economic and environmental perspective. Grazing infrastructure in relation to roadways, paddock layout and water system will be important in terms of overall animal performance as it can allow more days at grass therefore greater profitability.

Farm layout

Proper subdivision of grazing land into paddocks is essential to be able to successfully manage pastures and achieve desirable rotation intervals. Paddocks must be connected with an efficient roadway system so that herd can move from one paddock to any other paddock on the farm. An accurate map of the farm is essential; preferably GPS.

The ideal paddock system should include:

- About 20 to 23 full sized paddocks and a few small paddocks near the parlour/housing area for sick cows etc.
- The roadways from the parlour/farmyard to the paddocks should be wide, smooth and as short a distance as is practical.
- The paddocks should be big enough so that there is sufficient pasture for the full herd for 24 hours when the pre-grazing cover does not exceed 1300-1500 kg DM per ha and on a 21 day grazing rotation.
- Paddocks to be rectangle to square in shape and wetter paddocks should have longest sides running adjacent to the roadways to avoid poaching in wet weather.
- Alter paddock shape to facilitate stock movement into and out of the paddock i.e. stock move down-hill to exit paddocks.
- Roadways to follow contour where extreme and be wide with gentle sweeping bends
- Locate roadways on the sunny windy side of a ditch, hedge or tree line.
- Avoid putting roadways directly through springs or swampy ground.
- Plan underpasses carefully to allow for gentle slopes into and out of the underpass and for drainage.
- Main paddock gateways to be angled to the roadway with at least two gateways for each paddock.
- Plan for multiple gateways from the roadway for paddocks on wet ground or for paddocks to be grazed by small mobs near the parlour.
- Have several gateways between adjacent paddocks.
- One wire (electrified) fences between paddocks with interconnecting gateways.
- Electrified fences divided into sections with easy to access cut-off switches.

- Number the paddocks with a tag on the gate and on a map of the farm.

Paddock size

Long narrow paddocks results in too much walking over ground to graze the end of the paddocks creating an excessive risk of poaching. In excessively large paddocks grass re-growths are grazed if there are over three grazings per paddock. Using a strip wire to divide the paddock requires extra labour during the main grazing season. If paddocks are too small there will be insufficient grass for one grazing and a requirement for additional water troughs. The maximum depth of a paddock should be 250 metres (m) from the access roadway reducing to 100 m in wet areas more prone to poaching.

Feed Storage Infrastructure

While silage bales offer well recognised flexibility for harvest and feeding, long term (>15 months) storage of forage reserves is most consistently achieved through clamp storage. Assuming a target reserve 800kg DM per LU and a mean bulk density of 160kg DM per m^3, approximately $5m^3$ of forage storage capacity per LU is required in addition to normal requirements. Data on absolute or developmental changes in total forage storage capacity on livestock farms is lacking. However, the proportion of total capital outlay invested in feed storage (walled silos) under the Targeted Agricultural Modernisation Scheme (TAMS) 2014-18 was less than 5% (DAFM), indicating a lack of prioritisation of this infrastructure at farm level. This may limit the scope to manage feed reserves on a significant number of livestock farms

Feeding Infrastructure

Adverse weather, as drought, high precipitation or extended low temperatures, inevitably results in extended periods of forage supplementation. This often coincides with the spring period of peak calving workload and maximal risk of metabolic stress on peripartum animals. Provision of 0.6 to 0.65m linear feed space per cow alleviates social and nutritional stress on the herd. It also increases the range of diet options where forage availability is limited, as higher concentrate and low-fibre feed inclusion rates can be better managed if simultaneous feeding of the entire herd is possible. To maximize resilience to weather events, yard design should therefore factor in adequate feed space together with flexible grouping arrangements and a cow-to-cubicle space ratio of 1:1. These yard design goals hold across varying soil types and locations, and are complementary to the objective of maximizing days at pasture.

6. GRASS MEASUREMENT

Currently, In Ireland the level of grassland measurement remains at about 10% farmers completing routine grass measurements. Approximately 450,000 dairy cows are been managed at grass with PBI, this is about 30% of the national dairy herd. Grassland measurement is a hugely important KPI for a dairy farm, the grassland performance dictates the stocking rate, concentrate strategy and fertiliser program for the farm. Ireland has a clear opportunity to continue its grass based focused with better grassland management.

PastureBase Ireland (PBI) is an internet-based grassland management programme for all grassland farmers. PastureBase Ireland provides information to farmers in three main ways. First, short term benefits, after completing a farm cover the programme displays a grass wedge and calculates the average farm cover, cover per livestock unit, growth rate, etc. This helps farmers in the day to day running of the farm. Then when a farmer records 25 – 30 farm covers during the year, the programme calculates the total amount of grass grown in each paddock. This gives the farmer the opportunity to investigate paddocks which are under performing and furthermore take appropriate action. After a few years using the programme the farmer will be able to determine how much grass their farm can grass in an 'average' year and set their stocking rate on the farm accordingly. It will also make feed budgets easier to create and more accurate as there is a bank of information to assist farmers. A major problem is that many farmers do not know the grass growth capacity of the farm and are continually not utilising grass to a high level. Grassland measurement is a crucial methodology in overcoming this limitation.

7. FEEDING MANAGEMNT THROUGH EXTREME CONDITIONS

Grazing management in wet conditions

Spring 2018, challenged a lot of farmers physically and mentally. Spring time on dairy farms are particularly busy yards, with high calving rates, a lot of young calves needing husbandry, cows requiring more management post calving. It can become more difficult when poor weather conditions are added into the scenario.

Early spring grazing, can alleviate a lot of mundane tasks on farms, if cows are outdoors, less feeding, tractor work, silage pit maintenance is required. Cows are cleaner at milking time, less slurry maintenance is required. Therefore spring grazing has a lot of clear positives for the farmer's workload and the animal's health. The use of partial grazing and on/off grazing needs to be used more on farms in spring. A proper farm infrastructure is required to successfully achieve this. Simple cow spur roads, multiple access points, movable water troughs are all small parts of this regime that can help make it work easily. When grass is in short supply as was the case in Spring 2018, and when the farm infrastructure is poor, grass utilisation tends to be low. This puts more feed supply pressure on the system. Spring grass utiliation needs to be high whether grass is in high or low supply.

In recent years the use of once a day milking for three to four week periods in early lactation has been used by a growing number of farmers. Recent research (Kennedy et al.2019) has shown no difference in milk solids output per cow from such a regime. The concept of OAD is applied in early lactation, to ease the pressure of milking cows twice, when only a small proportion of the total herd is calved. This cocept will gain in importance in the coming years.

Feed management during drought conditions

In emerging drought conditions, the main priority is to reduce daily grass demand to below daily growth rate. This will help to hold grass cover on the farm, protecting current growth and speeding up recovery when rain arrives. Rotation length must be maintained at 25-27 days approximately. Effectively this means grazing no more than 4% of the grazing platform daily. Assess the grass available on this area and supplement with forage/concentrate to balance herd demand Increasing rotation length beyond 30 days may lead to much reduced grass quality however. Post grazing residuals of 4 to 4.5cm must be maintained. If there is large deficit between growth and demand it will be necessary to temporarily reduce demand further by reducing grazing stocking rate and/or feeding extra silage

Dry field conditions should make the task of feeding out forage much easier compared to during high rainfall periods. Each farm will have its own preference (based on facilities/machinery/labour) but the main objective remains to reduce total daily grass intake to the level of daily growth or below. Feeding forage will be necessary for many farms during drought. Once the available daily grass is known, some options for feeding high fibre supplements are:

- Separate a proportion of the herd and place on 100% silage plus meal in a convenient paddock. This may be a paddock marked for reseeding later in the year. A small area of fresh grass can be allocated to this group daily. Some farms have used a double temporary wire feeding rail to good effect. This approach simplifies grazing management of the main group.
- Offer silage to all cows in the grazing paddock, placing silage along perimeter fencing. This works best where feed can be allocated with a diet feeder. Total silage allocation should be calculated to balance available grass on the paddock daily. Forage should be spread along a long linear distance (1m per cow) to reduce competition and bullying.
- Hold a proportion of the herd in the yard for silage feeding after milking. These can be turned out with the main group after 3-4 hours feeding. This simplifies feeding out silage but in dry conditions there is a risk of injury due to slippery concrete floors
- High fibre straights can be offered PKE/hulls/pulp at a rate of 3-4 kg per cow. Some farms choose to feed these in mobile feed troughs in the field. Note that citrus pulp does not work well in this situation due to its lower NDF fibre content. Ensure full access to clean water.

Whichever action is chosen, it is vital to act early to ensure that grass supply is maintained out as early as possible. If covers are allowed to drop too quickly, it will result in the entire herd having to managed on silage for a period. Grass recovery will also be delayed. Plan to supplement until 4-5 days after growth exceeds demand, monitoring pasture covers and herd feed intakes closely with this in mind.

Areas closed for silage and accessible for grazing with <2200kg DM covers may be grazed as a standing supplement during drought. Pre-mowing does not confer any advantage in this situation. Zero grazing of outlying areas closed for silage may also be considered. A functional alternative to zero-grazing with specialized machinery during drought is to bale suitable herbage on outlying land areas and feed directly (as 'green bales') to the herd within 24-36 hours of cutting.

Recent work on zero grazing in NI (7) showed a significant drop in milk yield where heavy swards (2500 kg DM) were cut and fed, relative to cutting or directly grazing lower mass swards (<1600kg DM). Overall, the decision to cut-and-feed individual paddocks should take account on pre-grazing yield. If silage swards have surpassed a feasible pre-grazing herbage mass and are nearing harvest stage, then it is preferable to leave for silage cutting.

Parlour-fed concentrate will form a major part of daily feed allowance in drought conditions. Some decisions rules are:

- Feed up to 5-6kg of parlour concentrate per day as part of an overall feed plan. This is a relatively safe level provided adequate forage and water are provided. A further 2-3kg of high fibre straights can be fed out-of-parlour.
- Purchase concentrate based on UFL value, targeting a value of >0.94 UFL on a fresh weight basis
- Ration crude protein should be decided based on overall composition of the diet. In normal circumstances a 14% high energy ration would be adequate at grass. However, in the current situation it is likely that lower protein ingredients will form a significant part of the diet. Also, where grass is drought stressed and lacking N uptake, it is possible that sward protein content could be lower than normal.
- Therefore, it is recommended that a 16% ration be used if grass intake is around 7 to 10kg per day. If the herd is placed on silage full-time than a high energy ration of 18+% will be needed in the short term. These targets are for parlour rations fed at 4-6kg.
- Be careful not to overfeed magnesium. A rule of thumb is that cows will tolerate up to twice the recommended allowance over a shot period (100-120g per day). Above this level there may be issues with scouring as Mg has a laxative effect. Therefore if concentrate is formulated for a 2kg feeding rate then max feeding rate should be limited to 4kg

8. Early Warning System

Adverse weather has acute and chronic effects on farm activities, from power disruption and safety risks associated with storm events, to longer term problems such as forage shortages associated with prolonged poor growth. In both instances early warning systems to alert the wider farming population of likely risks and appropriate responses are warranted.

In the context of acute risks, the Met Eireann weather warning system provides an excellent basis for decisions on dissemination of timely advice. It is recommended that appropriate management templates encompassing power supply, health and safety, animal welfare, feed and water management, be developed for dissemination during Status Red conditions. These would be released through Teagasc to standard media channels, industry partners and farm representative bodies.

The task of developing early warning systems to chronic adverse weather issues is more challenging given the slower emergence of effects and relative lack of urgency in response. Furthermore, the degree of potential impact is more variable due to farm-to-farm differences in stocking rate, feed supply etc.; this can serve to dilute the impact of advisory messages. Nonetheless, a number of actions can be taken to improve farmers' real-time understanding of the type and scale of responses needed to counter emerging weather issues.

First, it is proposed that awareness of national pasture growth trends and critical management decisions be increased among the general population. Teagasc PastureBase provides the infrastructure to monitor temporal trends in pasture production. While the number of participating farms has increased over time the percentage of total farms regularly measuring pasture remains low particularly among drystock farms. A wider dissemination of pertinent growth and management data is required. This should include a design step to make key messages more accessible, for example by presenting data as qualitative or index-based rather than in overtly technical terms. A particularly useful addition would be delivery of timely messages on decision rules at silage harvesting time; further collaboration with Met Eireann in this regard should be explored.

It also is proposed that a national fodder survey be carried out by Teagasc annually. This will be carried out on 400 farms nationally in mid-to-late summer; it will be repeated within year if deemed necessary. Results of the survey will be used as a guiding narrative for late season and winter management. Central to this will be advice on budgeting of forage stocks, short-term cropping decisions, and forward purchasing of feed alternatives. A national forage management forum will be established comprising Teagasc, DAFM, farm representative organisations and industry partners. This will convene where it is clear that forage security risks are emerging. The committee will work to ensure that the appropriate alleviation measures have been put in place and that key messages reach target audiences.

Finally, it is proposed that a module on weather adaptation strategies for livestock systems be developed and included as part of standard Teagasc undergraduate courses. Module content or part thereof will be included in all training programmes for dairy managers and new entrants to dairying, as well as being made available for use with all livestock discussion groups.

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